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The Union Switch & Signal Co.

OF PITTSBURGH, PA.

General Office and Works, Swissvale, Pa.

New York Central Bldg. | Chicago Monadnock Bldg. | Montreal Commercial Union Bldg.

March, 1909. Bulletin No. 39

THE UNION ELECTRIC CROSSING GATE

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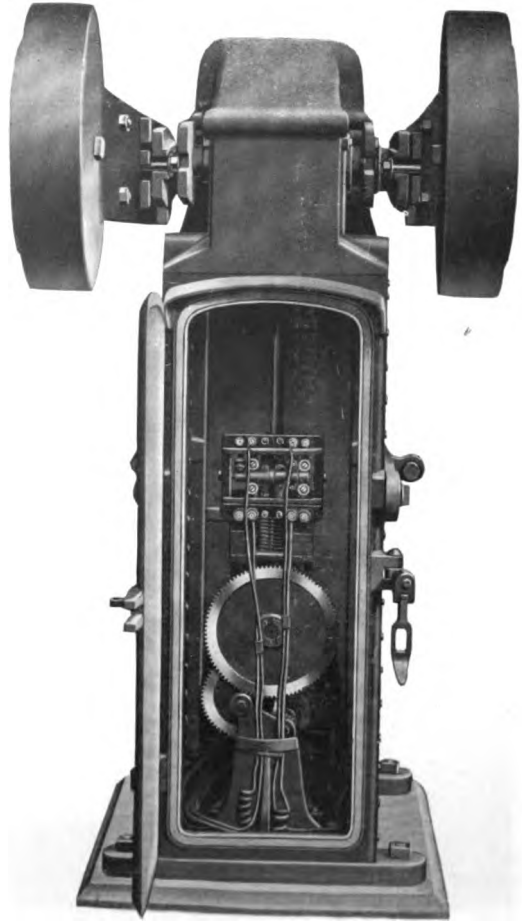

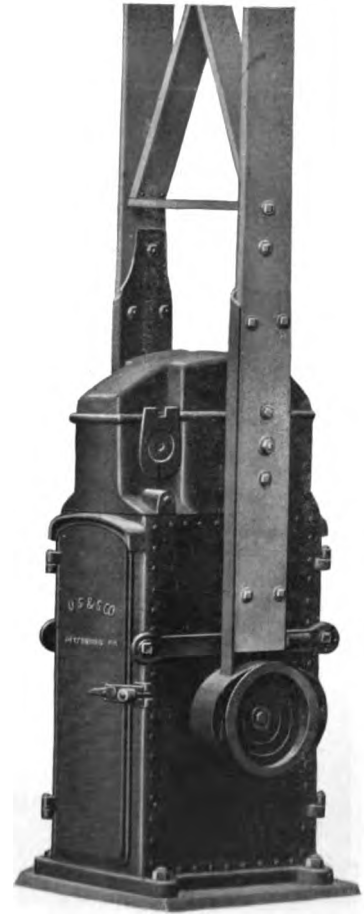

THE UNION ELECTRIC CROSSING GATE

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THE UNION ELECTRIC CROSSING GATE

CROSSING gates operated by power and controlled from a central location have hitherto employed pneumatic means for their operation. This involved the running of pipes, necessarily underground, and the consequent digging up of the streets.

The demand for a machine which could be more easily installed and maintained than the pneumatically-operated crossing gates, and whose operation did not make any excessive demand on the operator, has been met by the Union Switch & Signal Company in the development of a gate mechanism operated by an electric motor located in an iron case carrying the arms.

This motor may be either A. C. or D. C., and standard equipments are carried for 110 volts D. C.; 110 volts, single phase, 60 cycles; 110 volts, single phase, 25 cycles; 55 volts, single phase, 25 cycles.

These gates are operated by two double pole double throw switches in the tower, and may be reversed at any part of their movement.

On account of its being possible to use 110 volts, 60 cycles, there are very few cases where they cannot be easily installed in cities or large towns, because this voltage and frequency are almost universally standard for lighting purposes.

This motor consumes in one operation only a trifle more than the power consumed by a 16 C. P. lamp burning for one minute.

The Union Switch & Signal Co.

SWISSVALE, PA., March 1st, 1909.

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THE UNION SWITCH & SIGNAL COMPANY'S
PUBLISHING DEPARTMENT
Swissvale, Pa.

Press of
MURDOCH, KERR & CO.
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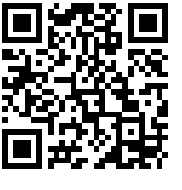

The Union Switch & Signal Co.

OF PITTSBURGH, PA.

GENERAL OFFICE AND WORKS, SWISSVALE, PA.

SALES DEPARTMENT

Hudson Terminal Building, 30 Church St., New York.

NEW YORK
Hudson Term. Building.

CHICAGO
Peoples Gas Building.

OCTOBER, 1910 BULLETIN No. 50

The Union Style "T" Electric Semaphore Signal

Reprinted from

The Signal Engineer

of September, 1910

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The Style "T" Top-Post Signal.

Fig. 1 is an elevation of the mechanism looking at the motor end, the view being in a plane at right angles to the semaphore shaft. Fig. 2 is a similar view with the motor and the mechanically operated circuit controller removed. The gears are shown in dotted lines and part of the casing is cut away to show the holding clear mechanism. Fig. 3 is a side elevation, partly in section, of the mechanism. This view is in a plane parallel to the semaphore shaft. Fig 4 is a horizontal plan view, partly in section, of the mechanism. Fig. 5 is a detail sectional view, and Fig. 6 is a top view of the slot magnet. Figs. 7 to 11 inclusive are detail views of the clutch which connects the motor with the gearing. Figs. 12, 13 and 14 are views of the controller operated by the slot magnet, and which directly controls the circuits of the motor. Figs. 15, 16 and 17 are detail views of the motor. Fig. 18 is a diagram of the circuits showing three signals in three different positions, operated on the normal clear plan. Fig. 19 is a similar diagram but on the normal danger plan. Fig. 20 is a perspective view giving a clear idea of the general arrangement of the parts.

The motor shown in Figs. 15 to 17, is of the bipolar type and has a toothed armature M wound with double silk covered copper wire thoroughly insulated from the iron. It has two independent shunt field coils F and F_1, the former is energized when the signal is clearing and the latter when the signal is returning to normal. The extremities of the pole faces are chamfered, as shown at 99, Fig. 17, to prevent the edges of the magnet hanging to the teeth of the armature, and interfering with its rotation. The surfaces of the chamfers are planes tangent to the curves of the pole faces, consequently the teeth of the armature pass into and out of the magnetic field gradually, and there is no point at which the magnetic attraction is greater than at points adjacent on either side. The forces on the armature due to the field alone are, therefore, balanced in all positions of the armature, and it is as free to rotate when the field is energized as it is when the field is not energized. There can thus be no tendency to hold the signal clear, even though the field should be excited, with no current in the armature.

The holding clear magnet, or slot magnet as it is usually styled, is of the iron-clad type, comprising a central cylindrical core surrounded by the exciting coil, and an iron shell enclosing and protecting the coil. The shell and core are connected at their upper ends by an iron disc forming the yoke of the magnet. The armature is a thin iron disc suspended below the magnet on the rod 70. The armature, as well as the core, is

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provided with core pins, or non-magnetic studs, for maintaining a minimum air gap. The exciting winding comprises two coils, one of comparatively low resistance for picking up the armature, the other having a resistance of 500 ohms or more for holding the armature when up. The former is connected to the terminal posts a and b, and the latter to the posts b and c. The core is bored longitudinally to

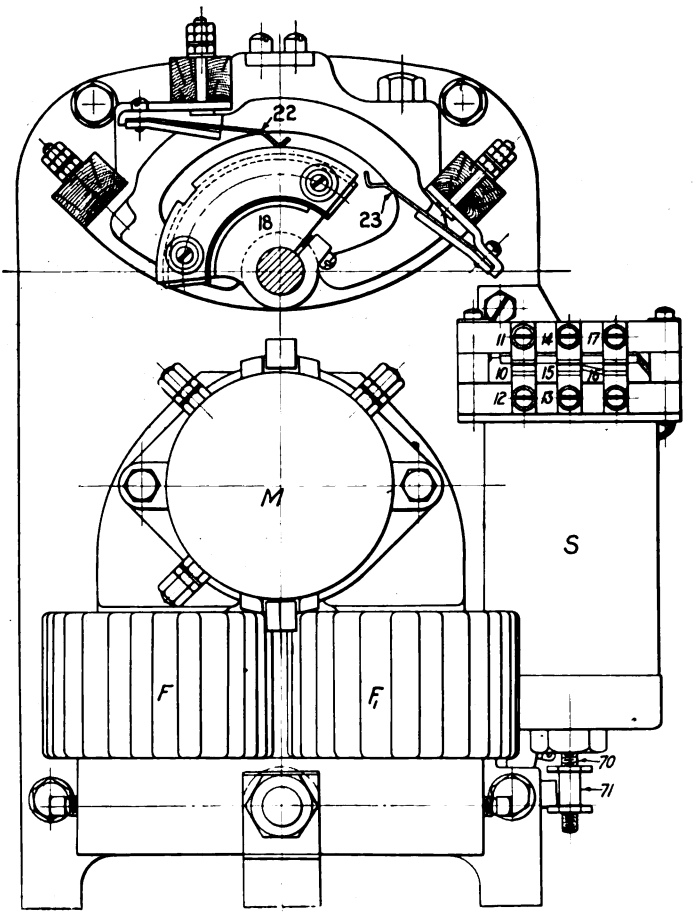

Fig. 1.

permit the rod 70 to pass through it. The rod 70 carries at its upper end the flanged adjusting nuts 98 which connect it with the circuit controller, and at its lower end similar adjusting nuts 71 which connect it with the holding clear mechanism.

The circuit controller operated by the magnet, Figs. 12, 13 and 14, comprises three contact fingers 10, 15 and 16, supported on a rocker shaft

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having a lever engaging with the flanges of the nuts 98, and contacts with which these fingers may engage. When the magnet is de-energized the fingers 10, 15 and 16 engage respectively with the contacts 11, 14 and 17; when the magnet is energized the fingers 10 and 15 engage the con-

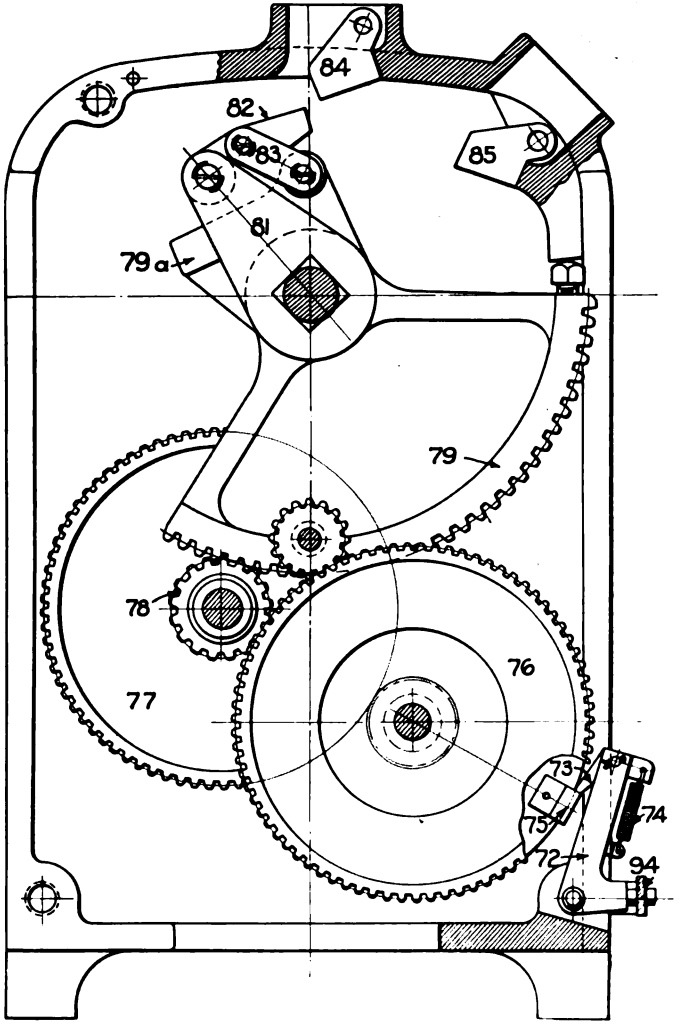

Fig. 2.

tacts 12 and 13 respectively, but the finger 16 touches nothing. The fingers 10 and 15 control the motor circuits; when the magnet is energized the motor circuits for clearing the signal are closed; when de-energized the motor circuits for driving the signal to danger are closed.

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The finger 16, when it touches the contact 17, forms a shunt around the high resistance coil of the magnet, which permits a comparatively

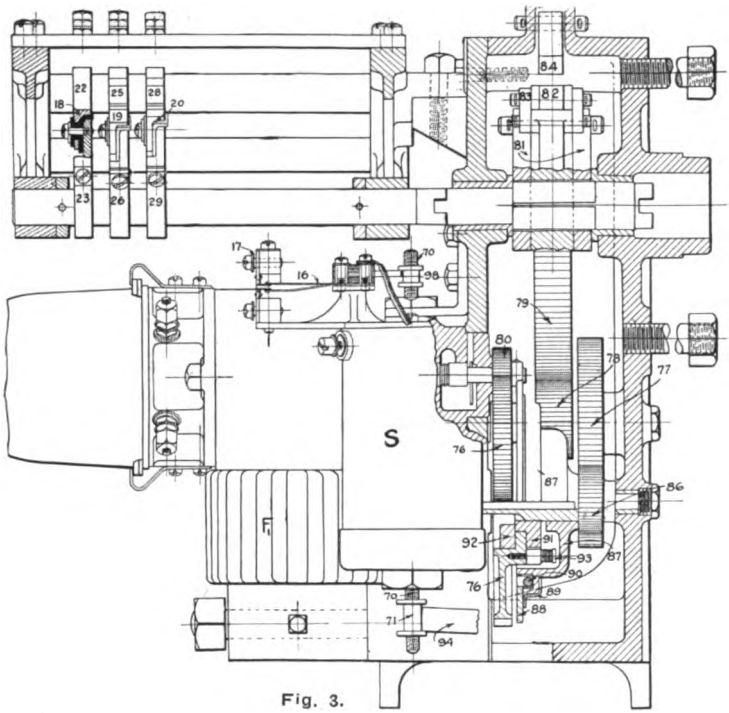

Fig. 3.

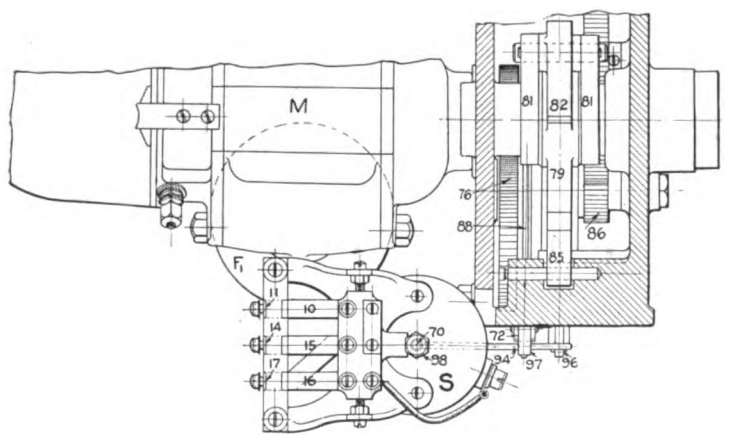

Fig. 4.

large current to flow through the low resistance or pick up coil When the armature reaches the upper limit of its travel, the finger 16 is sep-

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arated from the contact 17, thus introducing the high resistance coil into the circuit, and reducing the current to 20 milliamperes or less.

The holding clear mechanism is shown in Figs. 2, 3, 4 and 20. The flanged nuts 71 on the armature rod 70, engage the outer end of the lever 94 pivoted at 96 to the frame of the machine. The crank 72, also pivoted on the frame, has a horizontal arm with a stud projecting through the lever 94 between the pivot 96 and the end engaging with the flanged nuts 71, and an upwardly projecting arm carrying a latch 73 which engages

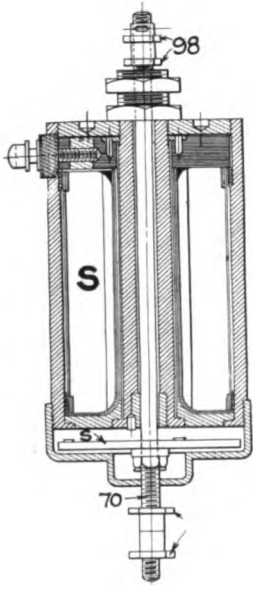

Fig. 5.

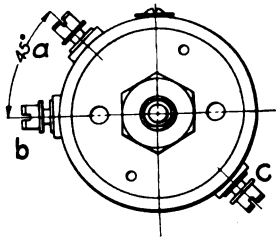

Fig. 6.

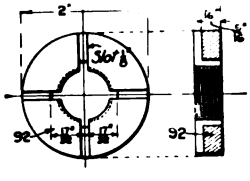

Fig. 8. Fig. 9.

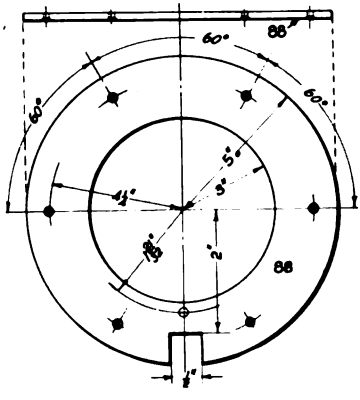

Fig. 7.

with a dog 75 on the wheel 88 carried by one of the shafts of the train of gearing, for holding the signal clear. The perpendicular to the surfaces of contact between the latch 73 and the dog 75, makes an angle of about thirty degrees with a line joining the surfaces, and the pivot of the crank 72, so that there is a strong tendency, due to the weight of the semaphore, to push the latch out of the path of the dog and release the signal. This tendency is resisted by the attraction of the magnet for its armature so long as the magnet is energized by the current. The

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latch 73 is pivoted to the crank 72 to permit of its being pushed out of the way of the dog 75 when the signal is clearing, and is held in normal locking position by the spring 74. The motion of the latch due to the spring is limited by a shoulder on the crank 72, so that in performing its function of holding the signal, it acts as a rigid member of the crank 72. The wheel 88 is connected to the gearing through the medium of a spring 90 (see Fig. 10) consisting of a single turn of heavy steel wire, to reduce the shock on the latch when the signal is brought to rest in its caution or clear position.

A clutch shown in detail in Figs. 7 to 11, is interposed between the motor and semaphore, to prevent straining or breaking any part of the mechanism if it should happen that the motor failed to hold the semaphore, as it would if the circuit happened to be open. Without this

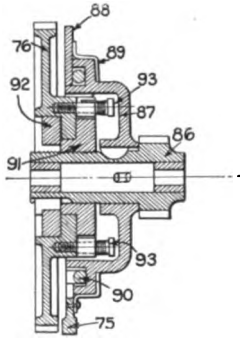

Fig. 10.

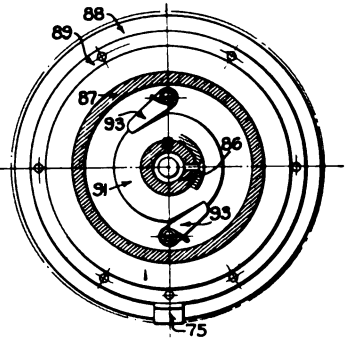

Fig. 11.

clutch, some part would be certain to break, or be strained beyond its elastic limit if the semaphore should drop from clear to normal without any retardation. If to secure the mechanism against strain were the only thing to be considered, a simple ratchet would be all that would be necessary, but when this requirement is taken in conjunction with the requirement that the motor drive the signal normal, something more than a simple ratchet is required; the clutch must hold enough to permit the motor to exert its force on the semaphore, and must let go before the stress becomes great enough to produce a strain.

The pinion 86 is an integral part of the shaft which carries it. To this shaft is keyed the cup shaped brass wheel 87, to which the wheel 88 carrying the locking dog 75, is fastened by means of the spring 90. The wheel 88 is secured in position by the flanged ring 89. About one-half of the shaft is threaded to receive two nuts 91 and 92, between which the gear wheel 76 is clamped. The nut 92 is keyed to the shaft 86, and is the medium through which the gear 76 drives the shaft and pinion, by means of the friction between the faces of the nut and gear in contact. The nut 91 is free to turn on the threaded portion of the shaft, and in turning has a lateral movement towards or away from the nut 92, the

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direction of lateral movement depending on the direction of rotation. The gear 76 is driven directly by a pinion on the motor armature shaft, and when it is driven in the direction to clear the signal, the nut 91 is turned by means of the pawls 93 in the direction to clamp the gear between the two nuts, which locks the gear to the shaft 86. When the gear 76 is turned in the opposite direction, it tends to unlock the clutch; but it requires a force to release the clutch about equal to that which tightened it, and as the semaphore is always started with a little jerk if the clutch happens to be loose at starting, the force required to release the clutch is easily double that required to clear the signal, but still far below that which would produce a strain.

The mechanically operated circuit controller for opening the motor

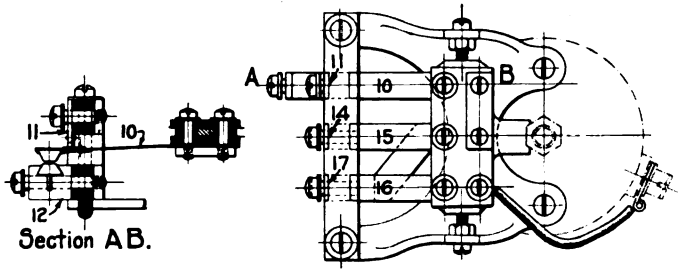

Fig. 12.

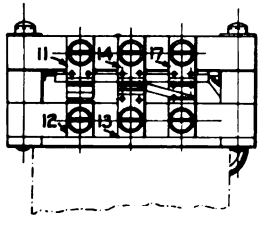

Fig. 13.

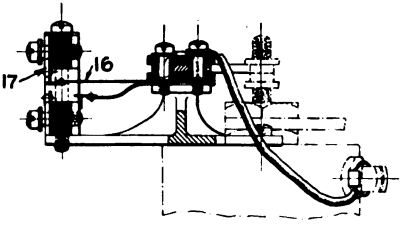

Fig. 14.

circuit when the semaphore has reached the position corresponding to the state of the track ahead, and for selecting the slot magnet circuits between the caution and clearing wires, comprises insulated sectors carried by the semaphore shaft, which co-act with brushes supported on and insulated by wooden bars carried on the frame of the machine. Three of these sectors are regularly employed; one for controlling the magnet circuits, another for controlling the motor circuits when the signal is clearing, and a third for controlling the motor circuits when the signal is returning to normal. The latter is shown clearly in front view, in normal position, in Fig. 1. This sector 18 has a notch cut in its periphery, for the purpose of opening the motor circuit, for an instant, just before the semaphore reaches the caution position, to permit

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of its stopping at this position if the state of the track ahead requires such a movement. Other sectors may be added if the signal is required to control circuits extraneous to its own government. The relation of the parts of this controller to one another, and to the circuits, will be better understood from a description of the circuit diagrams which follow later.

A mechanical lock is provided, when required by the purchaser, to prevent the signal being cleared by hand. A clear conception of this may be obtained from Figs. 2, 3, 4 and 20. The segmental gear 79 which is one extremity of the train connecting the motor with the semaphore is carried loosely by the semaphore shaft, and is connected by a pair of

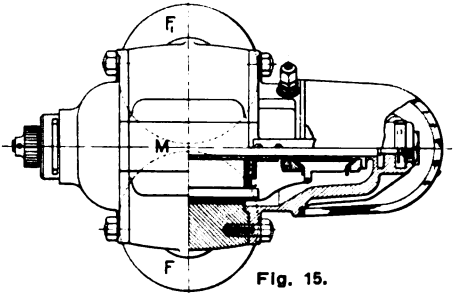

Fig. 15.

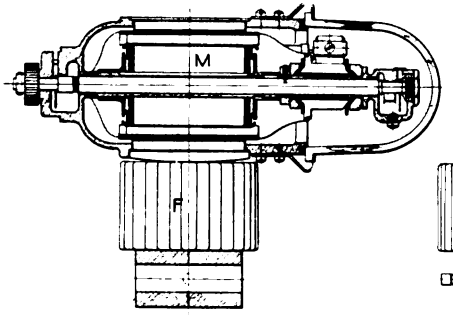

Fig. 16.

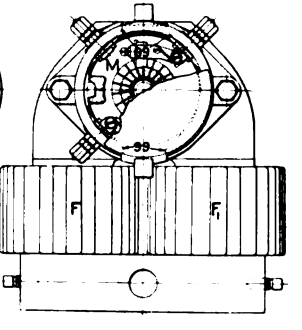

Fig. 17.

links 82 and 83 to a pair of arms 81 which are secured to the semaphore shaft by virtue of a square part of the shaft extending through square holes in the arms. The link 82 extends beyond the connection with the links 83 to form a latch which is capable of engaging with the dog 84 suspended from the frame of the machine. When force is applied to the semaphore arm, tending to clear the signal, the toggle formed by the links 82 and 83 is bent upwardly, which results in the latch striking end on against the dog 84, thus preventing movement of the semaphore. When the force is applied to the segmental gear 79, as when the motor is the agent, the toggle is straightened out, and the latch pulled down so as to miss the dog. To prevent the toggle being pulled into a straight

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line, a stop 79a on the gear 79 engages the arms 81, and prevents further relative movement between the gear and arms, while there is still a considerable angle between the arms of the toggle. If it should happen that the motor is called upon to drive the signal normal, the toggle would be bent by the reverse force applied to the gear 79. To prevent its interfering with the free movement of the signal, the dog 84 is pivoted so as to swing easily out of the path of the latch 82 when the normal movement is in progress. A similar dog 85 is provided for locking the signal in the caution position.

The semaphore shaft is formed in three parts joined by tongue and

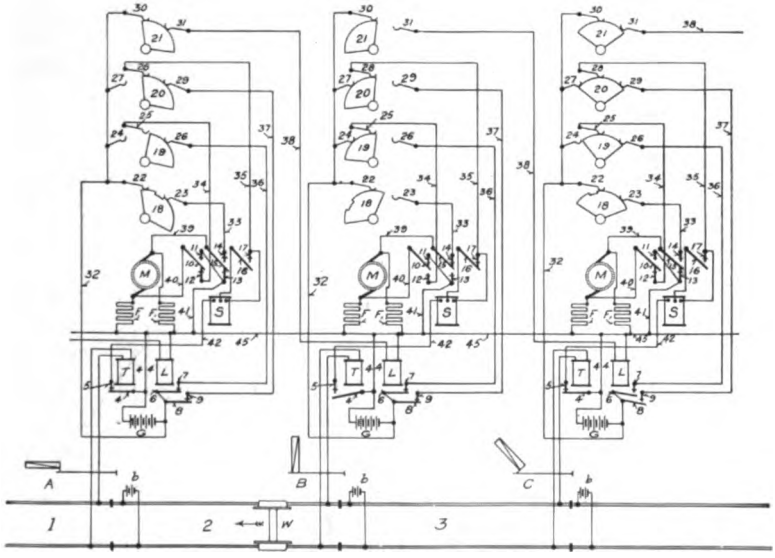

Fig. 18.

groove couplings; one part carries the sectors of the circuit controller, another, the segmental gear 79 and the arms 81, and the third the semaphore arm. This construction permits of the removal of the circuit controller without disturbing any other part, and allows the entire mechanism to be removed, leaving the semaphore arm in place.

Every precaution has been taken to reduce friction to a minimum. Ball bearings have not been used, as they add considerable to the cost of the signal, and tests show that there is very little, if any diminution of friction by their use. The motor has bearings of very small diameter provided with self oilers. The bearings of the two intermediate shafts are formed by boring large holes through the shafts, in which short brass bushings are inserted at each end of the shaft, through which extend small Stubbs' steel rods. The rods are free to turn in the bushings of the shafts as well as in the bearings in the frame, and by reason of their small diameter, and smooth hard surfaces, form bearings that

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are nearly frictionless. The semaphore shaft is made of high carbon steel, the hard smooth surface of which will not seize the bearings.

In describing the circuits employed in operating the signal, reference is made first to Fig. 18 which shows the application of the apparatus to signals operated on the normal clear scheme. Three position of the mechanism controlling the circuits are shown, corresponding to the danger, caution, and clear positions of the signal. A train represented by the wheels and axle W is in the block 2; the signal B governing that block, is at danger; the signal A ahead of the train is at clear; and the signal C, the second in the rear of the train, is at caution. When the train leaves the block 2, the track relay T corresponding to the signal B will be energized, and the contacts 4 and 5 brought together, thus

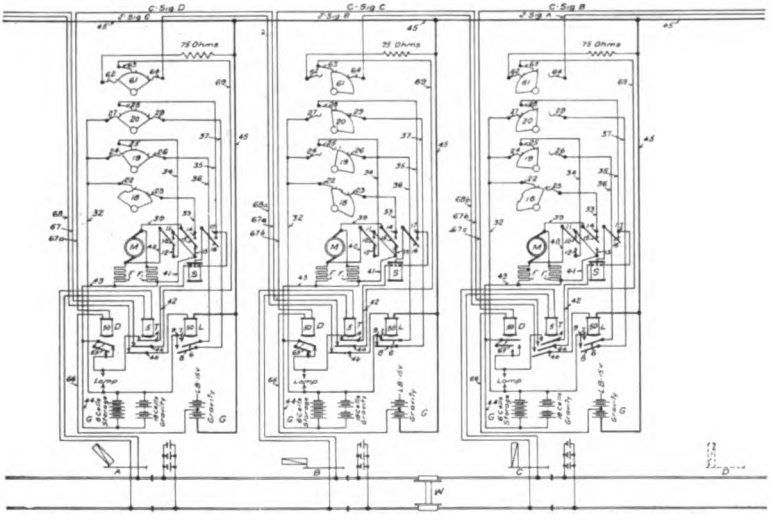

Fig. 19.

closing a circuit of the battery G so that current will flow from the battery, over the wire 32, brushes 27 and 28, wire 35, contacts 17 and 16, the pick up coil of the magnet S, wire 42, and contacts 5 and 4 to battery. The current energizes the magnet S, and picks up the armature which, when it reaches the limit of its stroke, separates the contacts 16 and 17, thus inserting the high resistance coil of the magnet into the circuit, and places the fingers 10 and 15 against the contact 12 and 13 respectively. The finger 10 touching contact 12, closes a circuit so that battery flows through wire 32, brushes 24 and 25, wire 34, contact 12, finger 10 and wire 40, to the bottom brush of motor. At this point the circuit divides, part passing through the clearing field F to wire 45 and part passing through armature M, wire 39, finger 15, contact 13 and wire 41 to wire 45: wire 45 is connected to battery G by wire 44, thus completing the motor circuit. The circuit 39, 15, 13

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and 41 closes a shunt around reverse field F_1, it also makes a closed circuit through armature M, wire 45 and field coil F. The motor armature and clearing field are energized by current through these circuits and drive the signal to the caution position, when the sector 19 leaves the brush 24 and opens the circuit of battery and motor.

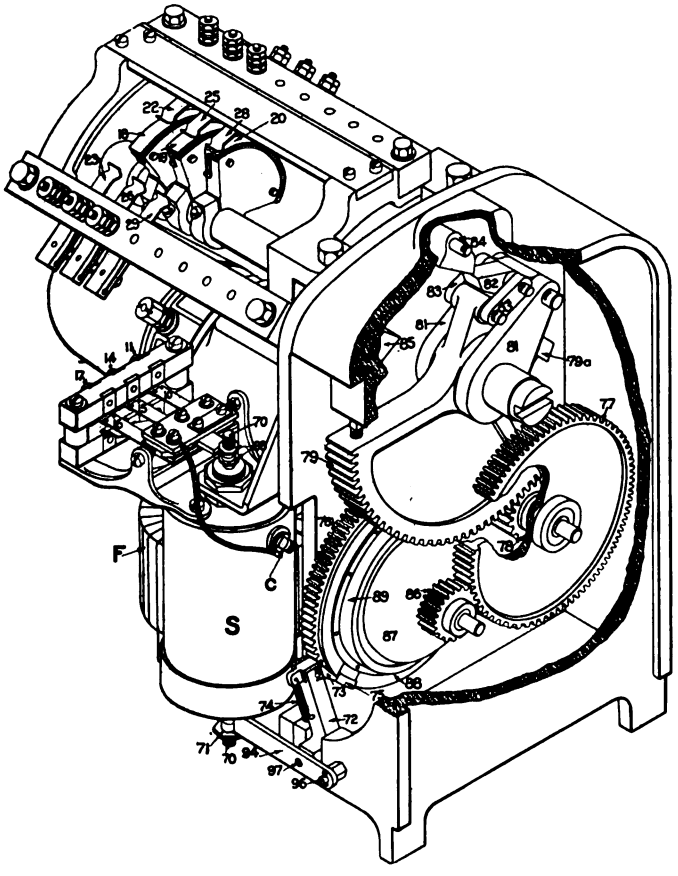

Fig. 20.

The brush 27 still remains in contact with the sector 20, and holds the magnet circuit closed; the magnet remaining energized, holds the signal at caution, and keeps the shunt circuit to the motor armature through the field F closed. The current produced by the counter-electromotive force of the armatures maintains the field, and quickly arrests the rotation of the armature.

When the signal B reaches the caution position, the sector 21 connects the brushes 30 and 31, thus closing a circuit, including the

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battery G, at the signal B, and the line relay L at the signal C through wires 38 and 45. The relay L, being energized, picks up its contact fingers 6 and 8, causing them to touch the contacts 7 and 9 respectively, thus closing a new magnet circuit through wire 37 and brush 29 to brush 28, thence through the previously described circuit to battery, and a new motor circuit through the wire 36 and brush 26 to brush 25, thence by the original circuits to battery. This results in driving the signal to the clear position, when the motor circuit is again opened by the sector 19 leaving the brush 25. The magnet circuit must be kept closed to hold the signal clear, so the sector 20 is set so as not to leave the brush 28.

When the train enters the block 1 it shunts the track relay T at the signal A, causing the circuit of the magnet S to be opened by the finger 4 dropping away from the contact 5. The de-energizing of the magnet S allows its armature to drop, release the signal, and rearranges the parts of the circuit controller so that the finger 10 touches the contact 11, and the finger 15 touches the contact 14. A circuit of the motor is thereby closed, and current flows through wire 32, brushes 22 and 23, wire 33, contact 14, finger 15 and wire 39, to upper brush of motor: then the circuit divides, part flowing through reverse field F_1 to wire 45, and part through armature M, wire 40, contacts 10 and 11 and wire 41 to wire 45: wire 45 is connected to battery G by wire 44. A shunt around the field coil F is formed by the circuit 40, 10, 41 and 45. Current through the field F_1 produces magnetism of the same polarity as that produced by current in the field F; but as the current in the armature has been reversed the motor runs in the opposite direction, and forces the signal towards the danger position. The current continues, with a slight intermission just before reaching the caution position, until the sector 18 leaves the brush 23, which occurs shortly before the signal reaches the danger position. During the short time elapsing between the separation of the sector 18 and the brush 23, and the arrival of the signal at the danger position, the current generated by the armature M, flowing through the field coil F_1, retards the motion sufficiently to bring the signal to rest gently on the stop.

If, while the signal A is clear, a train should enter the second block beyond from a side track, the track relay T would remain energized, but the line relay L would be de-energized by the next signal beyond dropping to danger, and opening the relay circuit between the brushes 30 and 31 on that signal. This would cause the fingers 6 and 8 to drop away from their respective contacts and open the motor clearing circuit, and the circuit of the holding magnet S. This would result in closing the motor normal driving circuit as above traced. The current would continue until the brush 22 reaches the notch in the sector 18, when it would be interrupted. Just before the circuit is re-established by the brush 22 again touching the sector 18, and after allowing time for the generated current to effect sufficient retardation, the sector 24 touches the brush 27 and re-establishes the circuit through the magnet S. Energizing the magnet

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S, picks up its armature, locks the signal at caution, and opens the motor normal driving circuit on the fingers 10 and 15.

The field coil F_1 has less resistance than the coil F. This is to permit a greater generated current to flow when the signal is going to danger than when clearing, because in clearing the weight assists in stopping motion, whereas in going to danger the weight is added to the load to be overcome by the motor.

It will be unnecessary to describe in detail the diagram, Fig. 19, as the local signal circuits are identical with those just described; the only difference is in the external means of control, with which all those interested in signaling are already familiar.

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The
Union Switch & Signal Co.

Swissvale, Pa.

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67

MARCH
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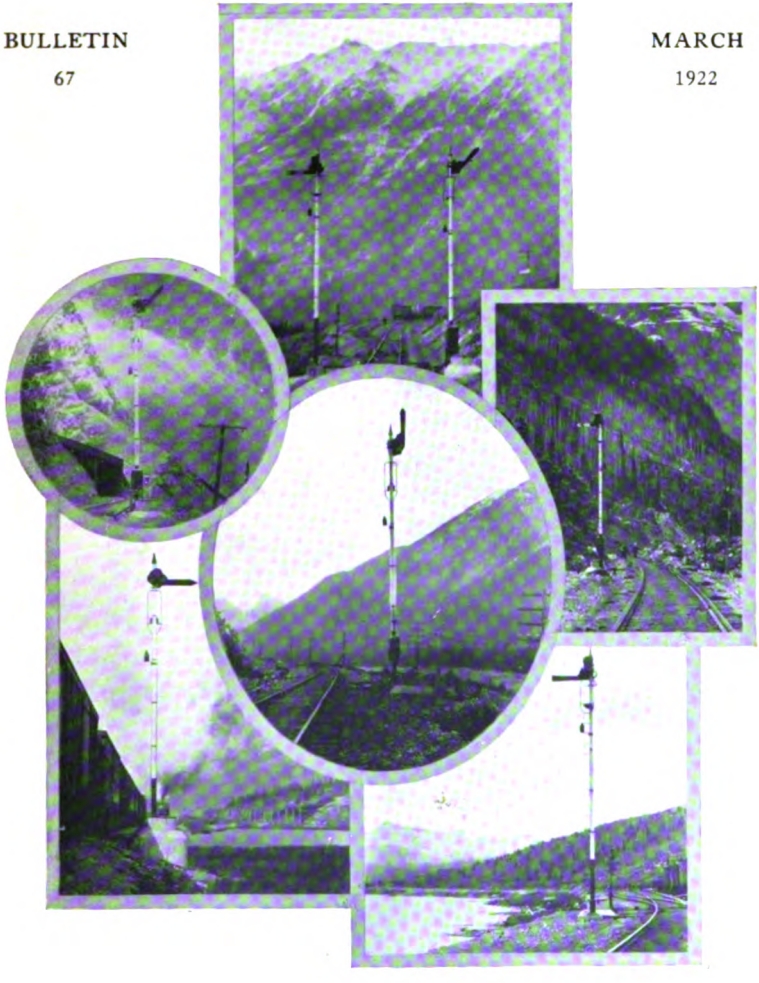

STYLE "T-2" SIGNALS

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STYLE T-2 SIGNALS

BULLETIN 67

Reprinted March, 1922

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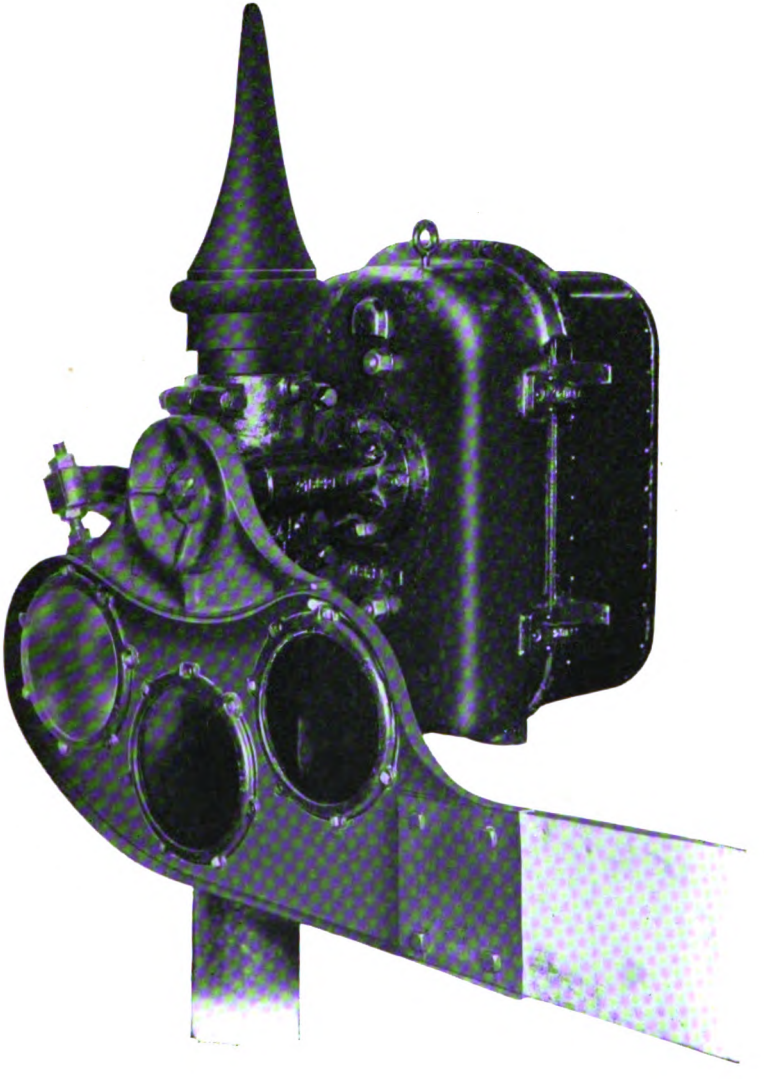

Fig. 1. Style "T-2" Signal. Front View.

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Fig. 2. Style "T-2" Signal. Rear View.

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THE UNION STYLE "T-2 SIGNAL"

The Style "T-2" Signal as illustrated throughout this pamphlet consists of a complete and independent mechanism unit for each semaphore arm. It is so designed that either direct or alternating current motors may be used and two or three position indications in any quadrant may be obtained. The changes may be accomplished by the substitution and interchange of parts as all important pieces are drilled by means of jigs. Simplicity, compactness, accessibility and strength, consistent with the service to be rendered are the chief characteristics of the design of the Style "T-2" Signal.

High and Dwarf Signals

Mechanism Case

The mechanism is mounted in a weatherproof, cast iron case, secured to the semaphore bearing, which also supports the lamp bracket and is arranged for clamping to a mast in any desired position by four bolts, Figs. 1 and 2. There are two ventilators, 35, Fig. 13, in the back of the case. Pipe conduit outlets, 49, Fig. 13, can be provided in either bottom corner. The door is hinged vertically to the case and is made of sheet iron riveted to cast iron frames giving lightness and strength to the structure. The door is about twice as deep as the case and when swung open as shown in Figs. 3, 10 and 11, the more important parts are exposed for inspection. An eye is bolted to the top of the case to facilitate hoisting into position.

Erection and Renewals

The entire mechanism may be removed from the case by unscrewing two nuts. In like manner each of the parts, such as the motor, circuit controller, etc., may be removed by unscrewing two stud bolts. This not only facilitates assembling but also enables subsequent changes and repairs to be made quickly.

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Dwarf Signal

When used as a dwarf signal the case is equipped with a set of lugs for bolting to a foundation. With the usual type of dwarf signal spectacle it is necessary to provide springs to obtain the counterweighting effect of the high signal semaphore arm.

The Mechanism

Gears

The operating mechanism consists of an electric motor driving a train of gears, the ratio of which is 120 to 1, a circuit controller and means for holding the signal in the proceed or caution position. The motor operates the semaphore shaft through the train of gears. The gears are dropped forged steel, cut with the utmost accuracy and with the exception of the main shaft run on roller or ball bearings. They are enclosed in a dust proof iron case which is secured to the mechanism case by two studs with hex nuts. This gear case may be clearly seen in Figs. 6 and 13 which show the mechanisms dismembered. Oil holes have been provided as indicated by "O" in the illustrations for the gear bearings. These holes are very accessible. It will seldom be found necessary to open the gear case or remove the gears, but if for any reason this is done and the gears dismounted, care should be taken to see that they are properly meshed when put in place again. Instructions for doing this will be found pasted in each mechanism case.

Semaphore Shaft and Bearing

The semaphore shaft is connected to that of the main segmental gear by a universal joint 31, and 32, Fig. 13, which insures smooth running and provides a means of easy connection. The semaphore shaft bearing contains recesses which are used as grease cups.

Friction Clutch

In order to relieve the strain on the gears, should the motor over-travel to such an extent as to bring the segmental gear against its stop, 25, Fig. 5, 21, Fig. 12, the pinion on the motor shaft drives through a friction clutch. This clutch is adjusted to slip with a torque of from one to two foot pounds.

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The Circuit Controller

The circuit controller is supported by a bracket attached by two stud bolts to the lower part of the gear case. It consists mainly of a revolving drum, E, Fig. 12, carrying contact segment 25, moving in a space enclosed by two porcelain insulated blocks which support the contact fingers. The drum is driven by the gears through an arc three times as great as, and in the opposite direction to, that through which the semaphore arm travels. The drum has a square steel shaft, 28, on which are assembled a series of moulded insulating bushings, 26, which have square inside holes to fit the shaft and are tapered and corrugated on the outside at one end to mesh with similar corrugations in the brass contact segments which are mounted on these bushings. The angular position of any segment may be changed by loosening the clamp nut 24, and disengaging it from the bushings. Adjustments as small as four degrees of the segment movement can be provided for in this way. This means one and one-third degrees adjustment in relation with the semaphore movement. A more minute adjustment of the contacts can then be secured by changing the position of the contact fingers on the supporting porcelain blocks. Each finger fits in a groove and is held in place by a screw 45, Fig. 13, through a slotted opening. This construction, together with the large angular movement of the drum enables any circuit to be closed or opened at exactly the desired position with a wide margin of safety.

Circuit Controller Segments and Drum

Adjustment

Contact Fingers

Each contact finger is clamped in position by a short strip of pointed steel which covers the slot opening and is maintained in alignment by a steel stiffening spring. Contact fingers are secured to the top and bottom of the supporting block as required. The binding posts to which the connections are made are enclosed within circular openings and are readily accessible from the outside vertical face of the blocks. Each binding post is held in place by the clamp screw which secures the contact finger through the

Binding Posts

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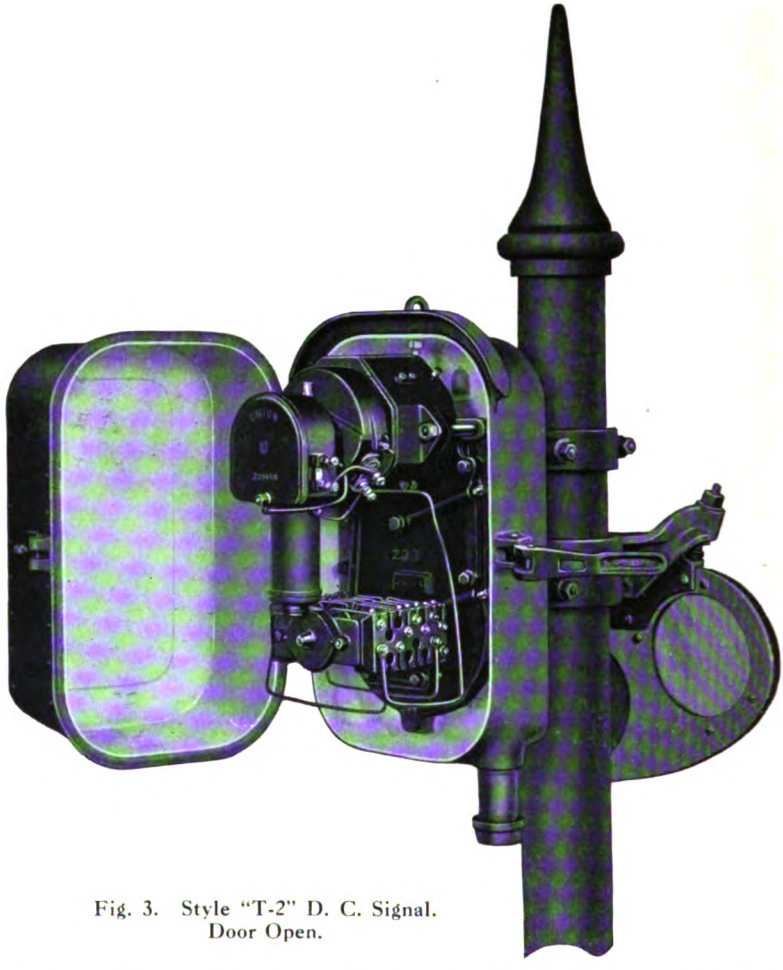

Fig. 3. Style "T-2" D. C. Signal.
Door Open.

slot in the porcelain; thus the process of removing or changing a finger can be instantly performed by releasing one of these screws. This type of controller provides a sliding contact of large area between fixed contact fingers and a moving segment entirely eliminating all moving wires. The insulation between the several parts carrying current is subjected to a ground test of 3000 volts.

Each controller carries eight contact segments. When all are not used, spare segments are provided in the form of complete

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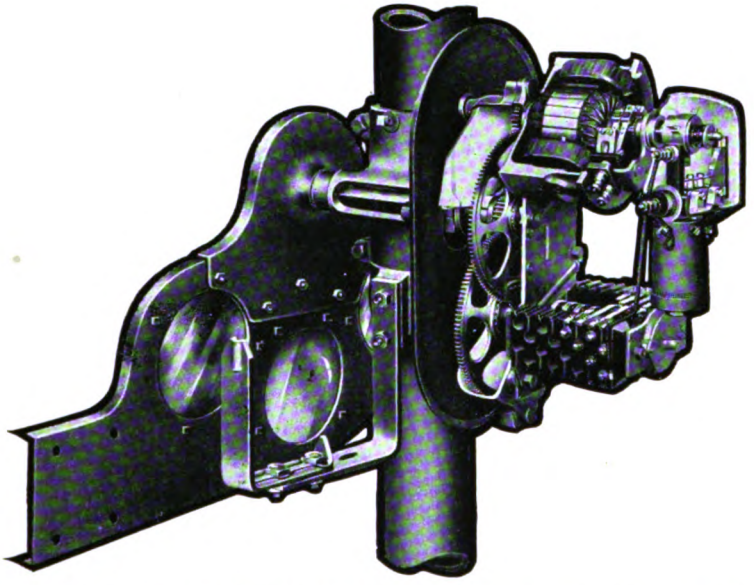

Fig. 4. Style "T-2" D. C. Signal. Parts Cut Away to Show Construction.

Spline Joint

circles and may be cut to any desired angle. For this purpose, as well as for making adjustments, the drum may be readily taken out by removing the front end bearing plates, as the drum shaft at its rear end is driven through a single spline joint, without pins or other fastenings.

D. C. Operation

This signal, for direct current operation, is provided with a direct current motor 24, Fig. 6, a holding slot and a combination of contacts in the circuit controller to suit. The holding slot controls the 45 degree motor circuit in addition to holding the semaphore arm in the caution or proceed position. As this slot can be inserted directly in a line circuit, the use of a relay at the signal solely for controlling the 45 degree motor circuit is unnecessary. The semaphore arm, when returning to the stop

Control of Slot

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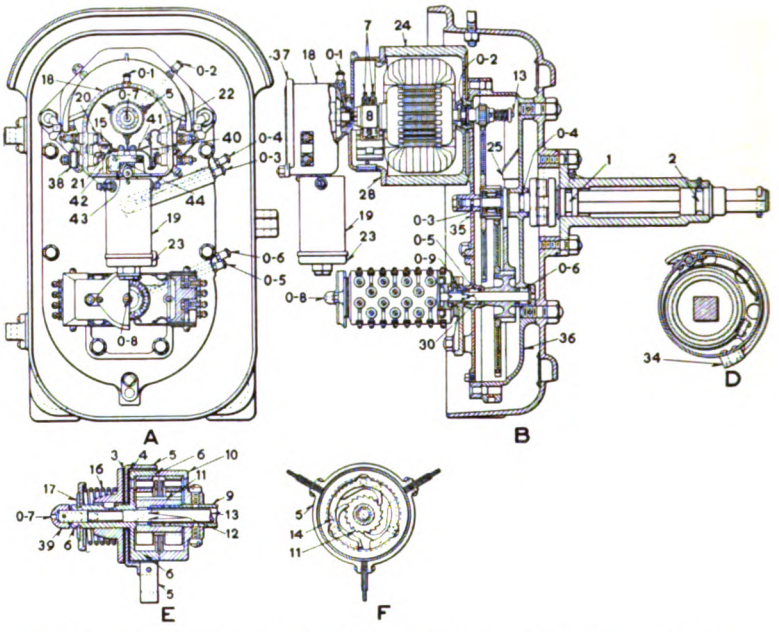

Fig. 5. Diagram of Style "T-2" D. C. Signal Mechanism and Parts.

Buffed by Dynamic Brake

position, drives the motor backwards, so that it acts as a generator discharging current through a resistance and the frictionless dynamic braking effect thus produced is utilized instead of a dash pot in retarding the backward movement. The D. C. signal is illustrated in Figs. 3 to 7, in which the same parts have the same references.

Motor

The motor is of the four-pole type having lugs raised on the field casting as a means of attaching it by stud bolts to the gear case. The armature 47, is mounted on a hollow shaft 9, Fig. 7. This shaft has a ratchet connection engaging only in the direction of rotation which moves the semaphore arm toward the caution or proceed position.

Ratchet Drive

When therefore, the semaphore arm returns to the stop position, this ratchet frees the armature to expend the momentum thus

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acquired without transmitting a strain to any part of the mechanism. The motor brushes are made accessible by the removal of a cast iron cover secured by two wing nuts.

The Holding Slot

Slot Magnet

The armature ratchet and the holding mechanism are placed in a cast iron case at the outer end of the motor shaft and there are, therefore, no exposed moving parts in the mechanism case except the drum of the circuit controller. The slot magnet is of the iron clad type very similar to the electro-pneumatic valve magnet in construction. When the magnet is energized, its armature stem raises arm 42 Fig. 5, on which steel stop roller 15 is mounted. This arm in turn causes the contact arm pivoted on the same shaft to close the motor circuit at 20. This movement brings the roller into the path of the blades 5, of the stop drum, stopping its rotation, but allowing the motor to revolve by virtue of the ratchet.

Holding Mechanism

When the slot magnet is de-energized the arm 42, is released and falls back by gravity. It is also assisted in this movement by the blade of the stop drum, which tends to force the roller out of engagement and thus release the slot mechanism.

In order that there may be no undue strain brought to bear on the gears and holding mechanism when the movement of the semaphore arm toward the stop position is arrested, the stop drum and blades are not only made extremely light and thus have very little mechanical inertia, but the drum is also connected with its driving ratchet through a friction clutch. By reason of this, the signal may be easily stopped at the caution position when returning from the proceed position, or it may be stopped when the movement is almost completed and started back to the proceed position without injury to the mechanism.

The armature is rigidly attached to the hollow shaft 9, to which the ratchet drum 10, is fastened by screws at E, Fig. 5

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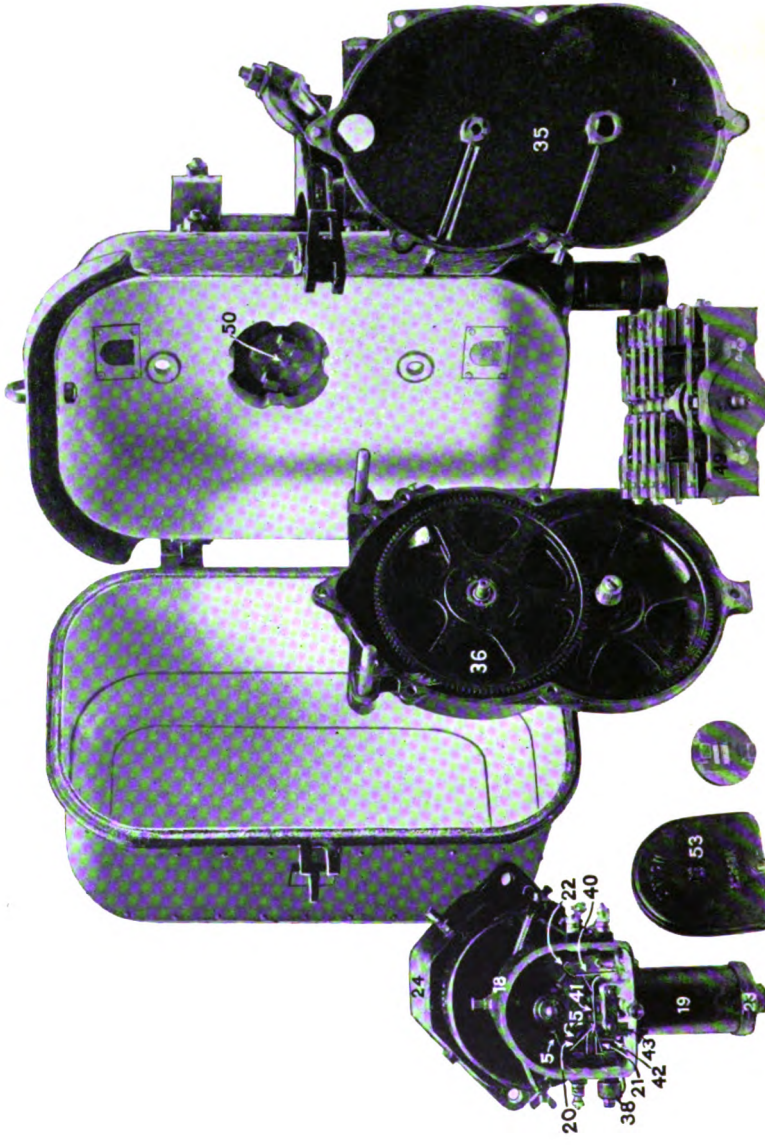

Fig. 6. Style "T-2" D. C. Signal Mechanism Dismembered.

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as mentioned above. This case carries the pawls 14, which bear against the brass sides of the case; the pins serve merely to prevent the pawls from dropping out when the ratchet is removed, lateral motion is prevented by the ring, 51, Fig. 7. The ratchet and pawls engage only when the motor is driving the gears in the process of clearing the semaphore arm. They allow the motor to run freely at the end of the stroke after being driven by the weight of the semaphore arm to the caution or stop position.

Stop Drum and Ratchet Case

Referring to E, Fig. 5, the outer end of the ratchet 11, is enclosed by a second ratchet case 6, carrying pawls which are supported in the same manner as those described above. The case 6, has a projection which serves as a bearing about the shaft 13, and to which is keyed a metal washer. This washer is free to slide longitudinally on 6, and bears against a rawhide washer 3. Against the outer face of the case is placed another rawhide washer 4, and between these washers is a stop drum 5. Spring 16 presses these parts together so as to form a friction clutch which will prevent injury to the stop blades 5, should they for any reason come into too violent contact with the roller 15. The slotted washer 17, takes the thrust of the spring 16, and permits the device to be easily taken apart. When the motor is clearing the signal the ratchet does not engage with the pawls in the stop drum and consequently it does not revolve, being prevented by one of the stop blades coming in contact with the roller 15.

Friction Clutch on Stop Drum

An explanation of the operation of the various parts in detail will be found pasted in the mechanism case of each signal under the heading "Suggestions for Maintainers."

D. C. Mechanism Wiring

Fig 8, shows the mechanism wiring for a signal to be operated by direct current at a potential not exceeding 30 volts. In this diagram contact segments of the circuit controller are represented

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Fig. 7. Style "T-2" D. C. Signal Motor.

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by the circles to the right. The segments are numbered from the outer end of the controller toward the gear case, from 1 to 8. No. 8, controls the motor circuit, 7, brings the slot under the control of the 90 degree control relay when the semaphore arm is at the caution position and 1, prevents this relay from energizing until the semaphore arm has assumed the caution position.

Controller Segments

To move the semaphore arm from the stop to the caution position, energy is supplied to the slot magnet 19, from the 45 degree control wire A, through contact segment 7, wire B, low resistance winding of the slot coil to wire C, contact 22, wire D, through the motor and to common. The slot thus energized raises finger 41, opening contact 22, which places the high and low resistance coils in series with wire E, to common holding the slot energized and contact 20, is closed completing the motor circuit through wires D and G, and contact segment 8, to energy, wire F. When the semaphore arm reaches the caution position, segment 8, will open the circuit of the motor, but the slot, remaining energized, will retain the semaphore arm in this position.

Movement from Stop to Caution

The semaphore arm is moved to the proceed position by energizing the 90 degree control relay which requires contact segment 1 to close its contacts as previously mentioned. With this relay energized, contact segment 7, is shunted by wire H. The slot magnet however, still receives its energy from the 45 degree control wire A. Another point on the relay closes the motor circuit through wire I, and the lower contacts on segment 8. This segment, as before, opens the motor circuit when the semaphore arm has reached the proceed position and 7 opens on the first movement of the semaphore arm toward this position. Adding the jumpers P, and Q, has the effect of shunting out the 90 degree control relay. They are used for two-position operation from 0 degrees to 90 degrees.

Movement from Caution to Proceed

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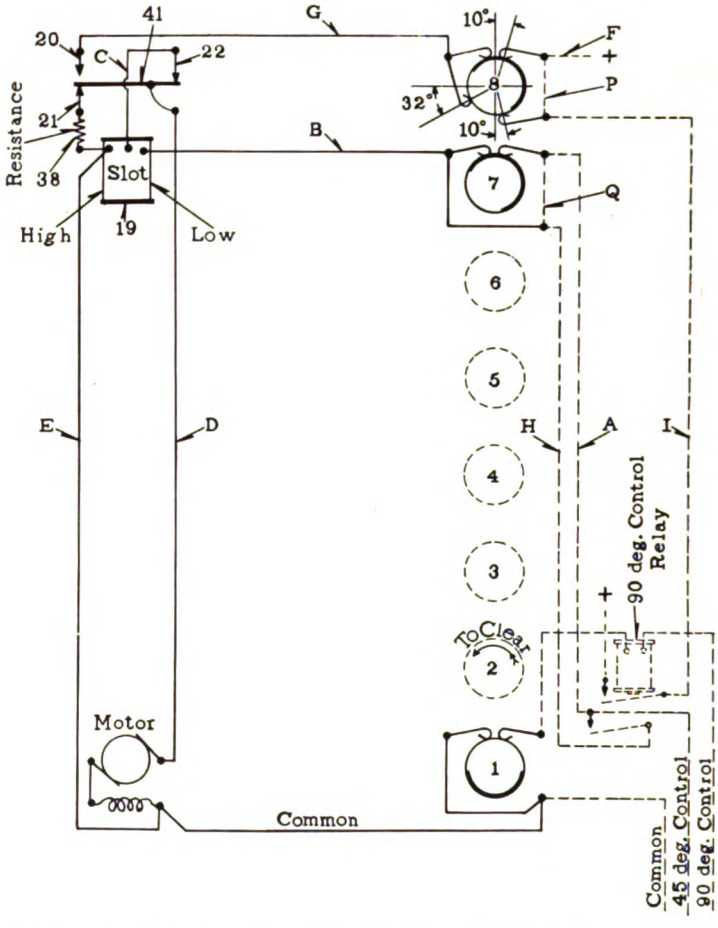

Fig. 8. Mechanism Wiring. Low Voltage Style "T-2" D. C. Signal.

De-energizing the control circuits will cause the slot magnet to release. The back point of finger 41, will then make contact at 21, thus closing the "buffing circuit" on the motor through wire D, finger 41, resistance 38, and wire E, to slow up the movement of the semaphore arm as it approaches the stop position as previously described. If the 90 degree control relay only

Return to Stop Position

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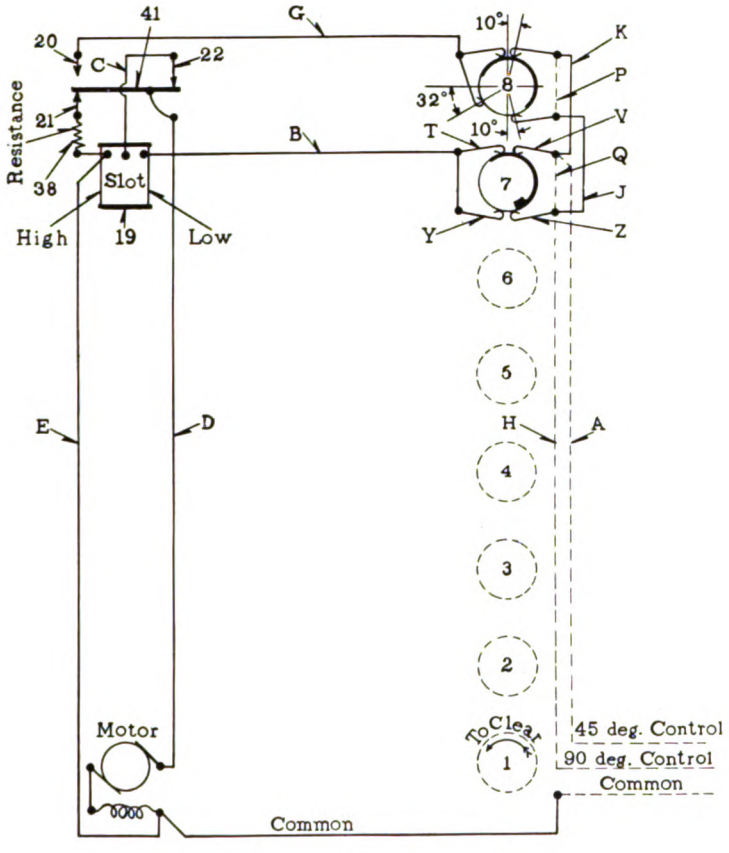

Fig. 9. Mechanism Wiring. Low Voltage Style "T-2" D. C. Signal with Snap Circuit Controller Segment.

is de-energized the slot will be released until contact segment 7, closes the circuit at the caution position when it will hold on the 45 degree control circuit.

The circuit shown in Fig. 9, differs from that just described in that there is no 90 degree control relay, as is the case when

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Circuit Without 90 Degree Control Relay

polarized track circuits are used. In this circuit the control wires also carry the current for operating the motor. The 45 degree control circuit energizes the slot magnet in a manner similar to that shown in Fig. 8. The jumpers J, and K, are provided to carry current for the motor between segments 7, and 8, the circuit of which is otherwise the same as that previously described.

The segment 7, transfers the slot circuit from the 45 degree to the 90 degree control wire when the blade begins to move toward the proceed position. For this purpose the bottom set of fingers Y, and Z, are provided. A peculiarity of this segment is that the contacts Y, and Z, close before contacts T, and V, open when the signal is clearing, but when the movement is from the proceed to the caution position this condition is reversed; that is contacts Y, and Z, open before contacts T, and V, close. This prevents the motor from being energized through wire J, which would cause the signal to pump. To secure this result a snap segment 34, D, Fig. 5, is provided which, when the semaphore arm is being moved to the stop position, has the same movement as the controller shaft, but when moved in the opposite direction is so held by friction with the contact fingers that it moves through a smaller arc than the shaft until the pressure of the fingers is released with the semaphore arm in the caution position. In this position the slot magnet is energized by the 45 degree control circuit. It will be noted that the 90 degree control circuit first operates the motor causing segment 7, to close contacts Y, and Z, and open contacts T, and V. The purpose of the jumpers P and Q, has been described in connection with Fig. 8.

Snap Segment

For voltages greater than 30 volts, circuits similar to Figs. 8 and 9 may be used. Other modifications may be introduced to meet any special conditions. The winding of the motor must, of course, be suited to the voltage of the circuit.

High Voltage Circuit

When used with polarized track or line circuits, two contact segments of the circuit controller are arranged to act as a pole

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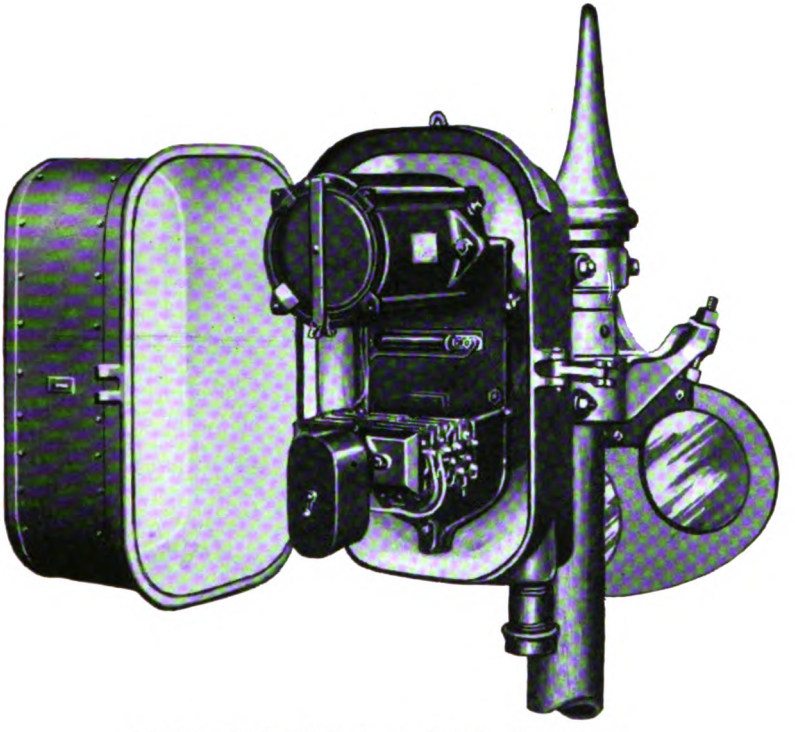

Fig. 10. Style "T-2" A. C. Signal. Door Open.

changer for reversing the polarity of the track or line circuit. Indication locks for interlocking signals may be controlled by one of the controller segments cut for the purpose. In each mechanism case will be found a wiring diagram showing how the mechanism is connected up.

Pole Changer

A. C. Operation

This signal is fitted for A. C. operation by the use of an A. C. motor, holding slot and an arrangement of circuit controllers to suit. It differs from the D. C. arrangement in that the slot is in the form of a rotor and stator so that all latches or other mechanical holding devices are eliminated. This arrangement of the signal is shown in Figs. 10, to 15, in all of which the same parts have the same references.

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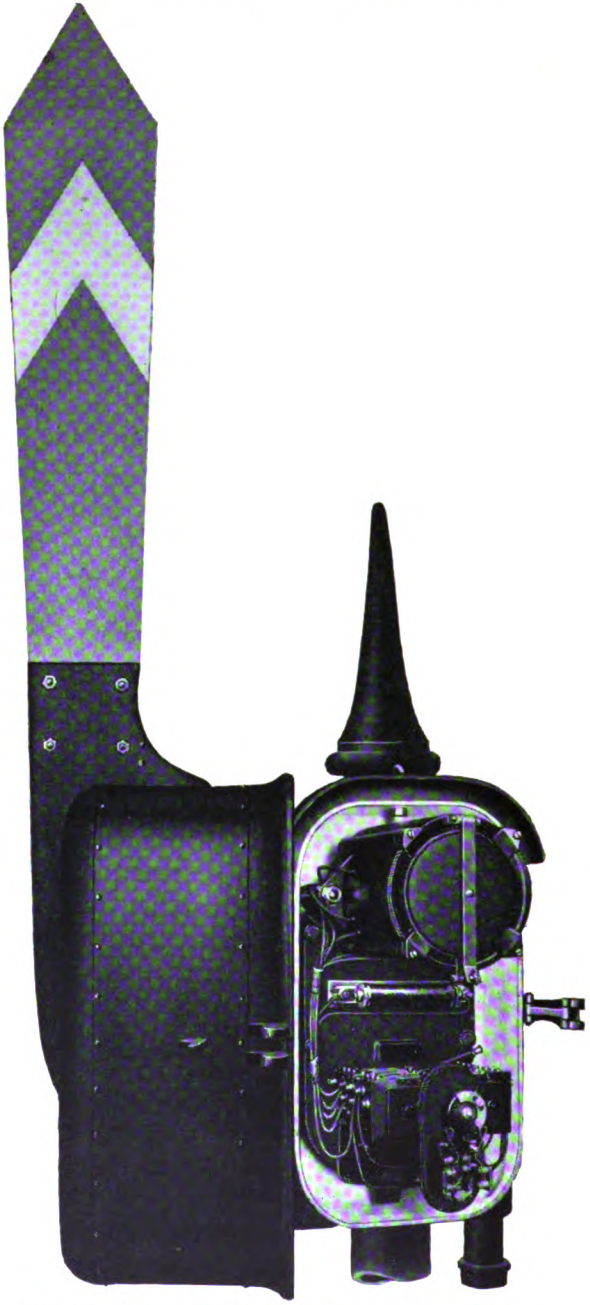

Fig. 11. Style "T-2" A. C. Signal. Door Open.

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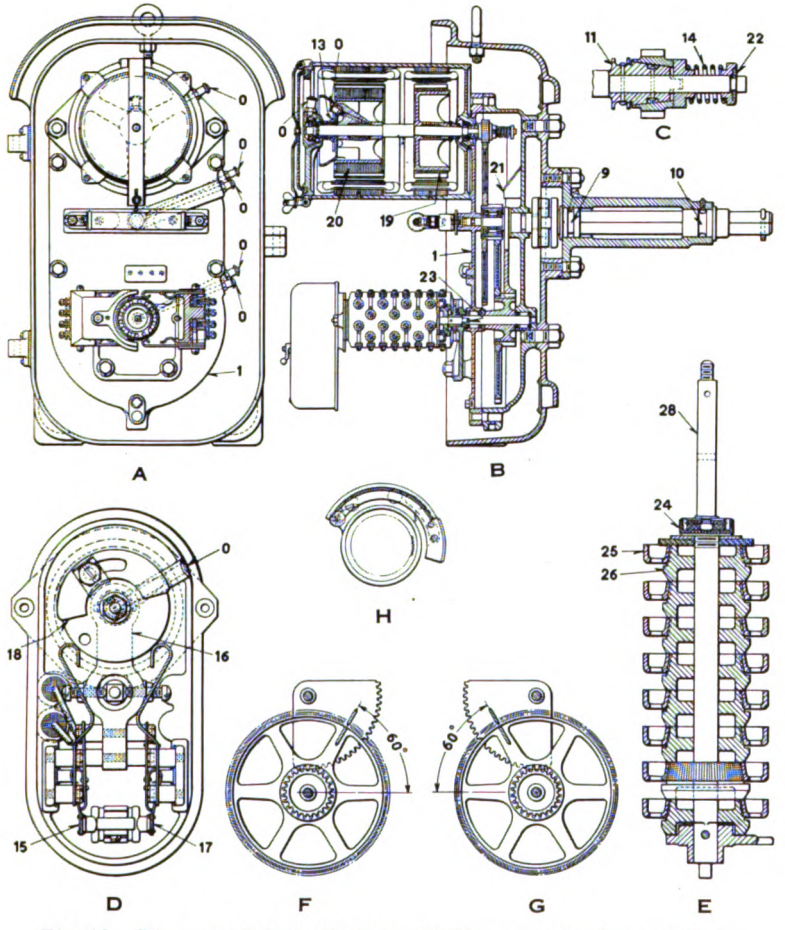

Fig. 12. Diagram of Style "T-2" A. C. Signal Mechanism and Parts.

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Motor and Slot

The motor and slot 37, Fig. 13, are enclosed within the same casing 60, Fig. 14, and secured to the gear case by the same stud bolts as in the case of the D. C. motor. The motor is of the induction type with standard squirrel cage rotor 20, and laminated stator 40, made of transformer steel. The bars and end plates of the rotor are securely riveted and well soldered together. The construction of the slot is very similar to that of the motor except that it is not so wide and contains only eight poles. The slot rotor 19, is mounted rigidly on the pinion shaft. There is a single winding on the slot stator 39, which produces a flux between the adjacent pole pieces. The rotor bars tend to take up a position outside of this field which is the middle of the stator poles and by inductive reaction will resist any effort to drive them into this field. Thus the slot holds the mechanism in the caution or proceed position.

Squirrel Cage Rotors

Method of Holding

The motor rotor is loosely mounted upon the pinion shaft which it engages through a ratchet 13, when driving the semaphore arm towards the caution or proceed position, but it is freed from the shaft on the backward stroke after the semaphore arm comes to stop the same as in the case of the D. C. motor. This ratchet can be inspected by opening the door at the front end of the motor case. The shield is provided to guard against the possibility of broken parts getting into the air gap and interfering with the free movement of the rotor.

Driving Ratchet

A. C. Mechanism Wiring

The mechanism wiring shown in Fig. 15, is for single phase operation and intended for use with a three-position relay. Contact segment 2, controls the motor circuit for the proceed position and segment 3, which is provided with a snap segment H, Fig. 12, controls the circuit for the caution position. Segment 4, controls the slot circuit. When used for three position signals an auxiliary circuit

Single Phase Operation

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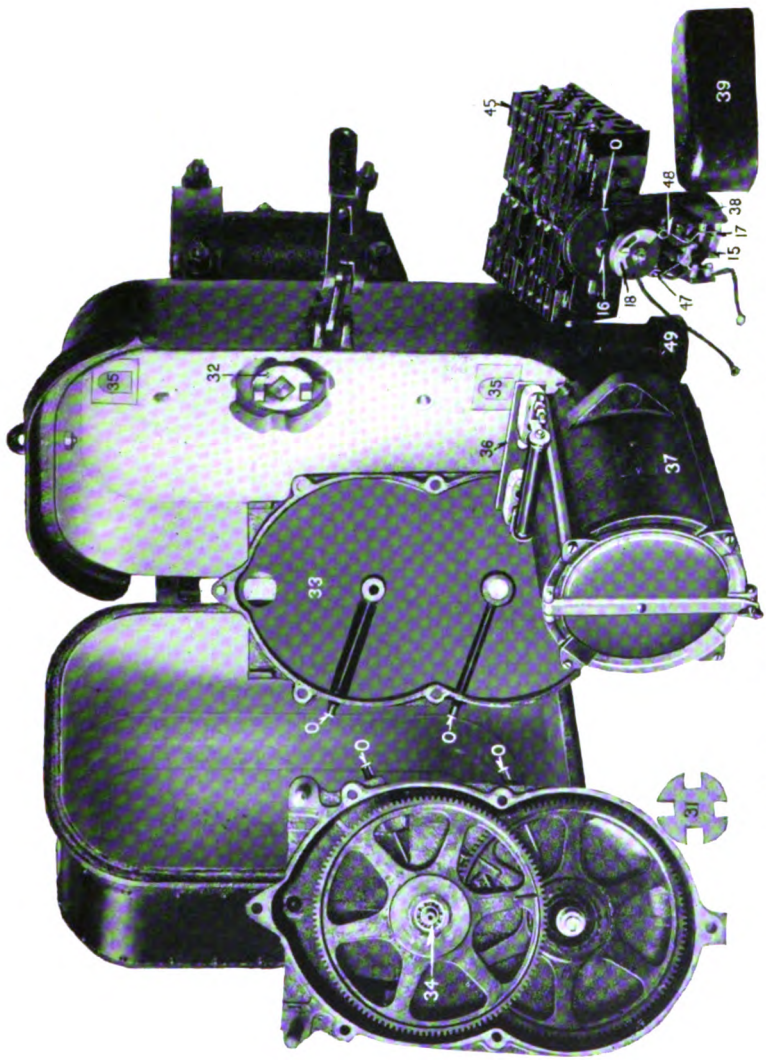

Fig. 13. Style "T-2" A. C. Signal Mechanism Dismembered.

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Fig. 14. Style "T-2" A. C. Signal Motor.

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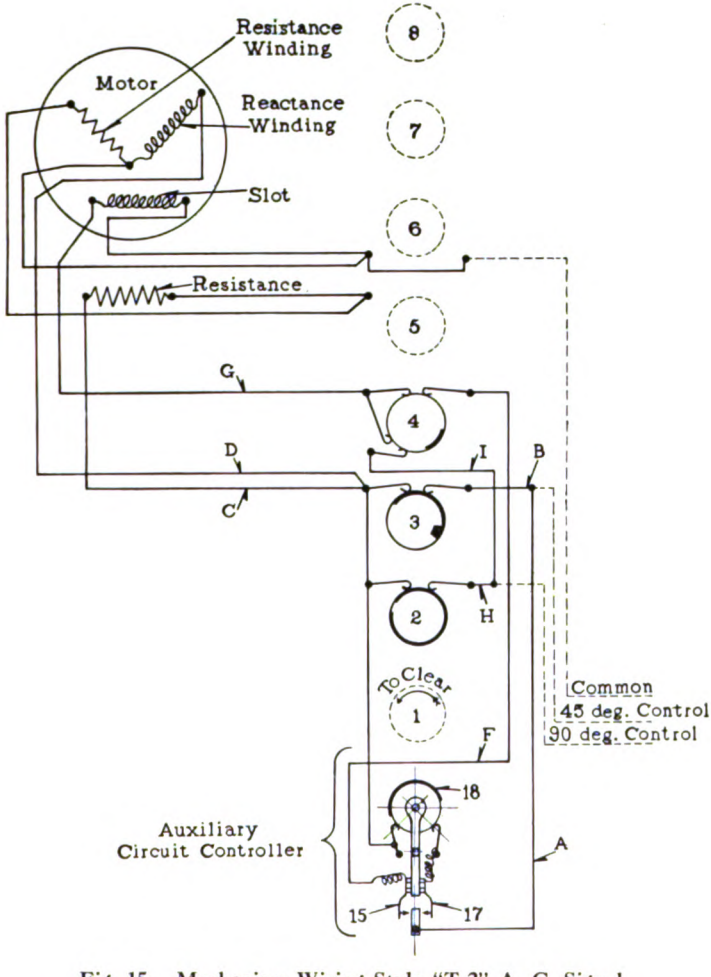

Fig. 15. Mechanism Wiring Style "T-2" A. C. Signal.

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controller attached to the end of the regular circuit controller shaft is used to produce a retarding torque through the motor when the semaphore arm is returning from the proceed to the caution position and thus assist in bringing the rotor of the slot to a stop so as to enable it to hold. This controller, D, Fig. 12,

Auxiliary Circuit Controller

consists of a contact segment 18, and a vertical arm 16, which carries two movable contact fingers 15, and 17, at the lower end. This arm has a limited horizontal motion between two stop screws which enables the circuit to be closed at 15, in one direction, and at 17, in the other direction. By a friction drive, contact 15, is held closed when the semaphore arm is being moved toward the proceed position.

When energy is supplied to the 45 degree control wire it passes to the motor through contact segment 3, and wires C, and D. The circuit of wire C, includes a resistance coil 36, Fig. 13,

Movement from Stop to Caution

secured to the gear case under the motor. This is used to produce a phase displacement between the currents in the two windings of the motor stator to bring about the effect of a rotating magnetic field usual in motors of this kind. The motor winding connected with this coil is known as the resistance winding. The winding of the motor connected to wire D, is known as the reactance winding. The windings connected to wires, C, and D, make connection to common.

The holding circuit in the caution position is through wire A, contact 15, wire F, contact segment 4, and wire

Holding Circuit

G, through the slot winding to common. When the 90 degree control circuit is energized the motor circuit is completed through wire H, and contact segment 2, in the manner described above. The holding

Movement from Caution to Proceed

circuit in the proceed position is through wire I, contact segment 4, and wire G, to the slot coil.

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Fig. 16. Style "T-2" Dwarf Signal. Front View.

Polyphase Signal

When polyphase current is used, the resistance referred to for phase splitting with single phase current is unnecessary. The motor, of course, must be suited to the characteristics of the current and the frequency.

When the semaphore arm is returning from the proceed to the caution position the auxiliary circuit controller is brought into play. In this case contact 15, is opened and contact 17, is closed and the circuit to the motor from the 45 degree control

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wire is completed through the contact fingers bearing against contact segment 18, these fingers are shown at 47, and 48, Fig. 13.

Return from Proceed to Caution

Segment 18 is adjustable and closes the circuit between fingers 47 and 48 at about 70° when the semaphore arm is moving towards the caution position. This tends to stop the motor and to produce rotation in a direction to move the semaphore arm towards the proceed position again. As soon as the mechanism is stopped, which occurs at approximately 45 degrees, the first movement of the mechanism towards the proceed position opens the motor circuit at 17, and closes the slot circuit from the 45 degree wire at 15, thus enabling the slot to hold in this position.

The mechanism wiring for a two position signal is somewhat simpler, contact segments being necessary only to open the motor circuit and close the slot circuit. No auxiliary circuit controller for buffing is needed for the two position signal because naturally,

Two Position Signal

the return movement of the semaphore arm does not have to be slowed up so that the slot may hold at caution; the rotating parts do not accumulate sufficient momentum to cause jarring at the stop position. In each mechanism case will be found detailed instructions for the care of the signal entitled "Suggestions for Maintainers" together with a wiring diagram.

This signal is not only universal in its aspects and indications, but is also universal in its applicability to interlocking and block signal work and can be controlled from either line or local energy

Typical Circuits

with a proper arrangement of circuits. The application of A. C. signals to automatic block signaling is shown in Fig. 18. Fig. 19, shows a D. C. signal connected up for non-automatic operation at an interlocking plant. The various apparatus and circuits involved are named in these illustrations and will be readily understood.

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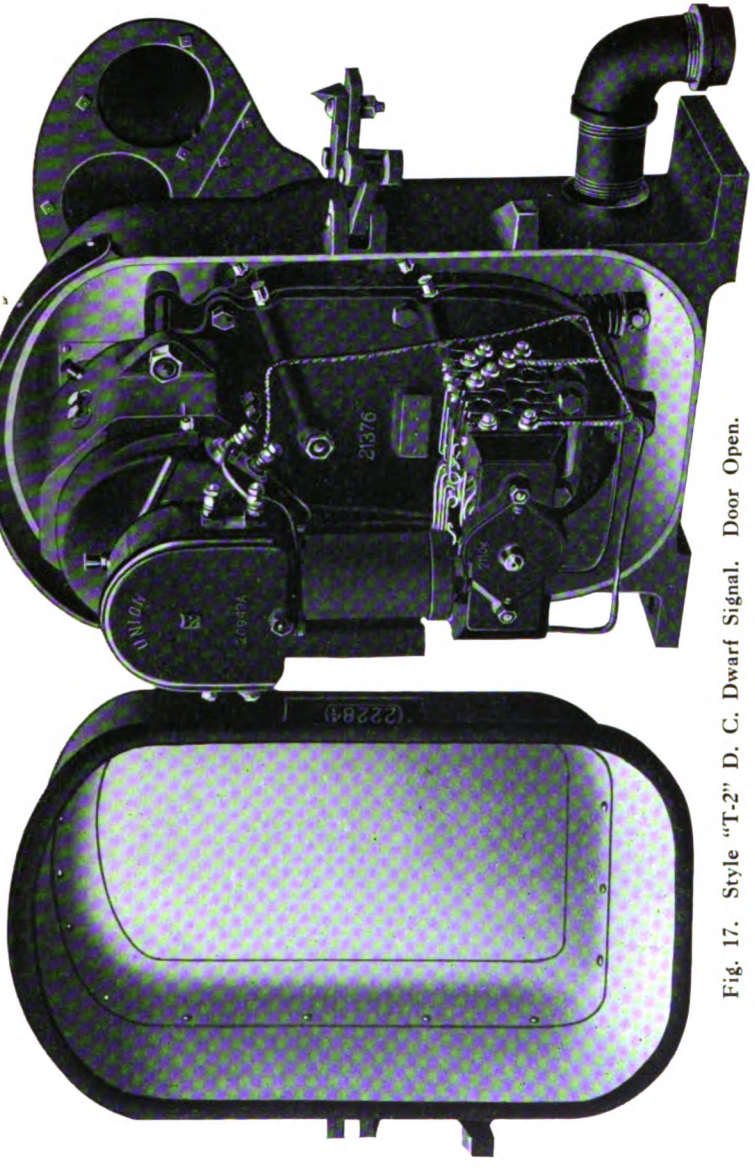

Fig. 17. Style "T-2" D. C. Dwarf Signal. Door Open.

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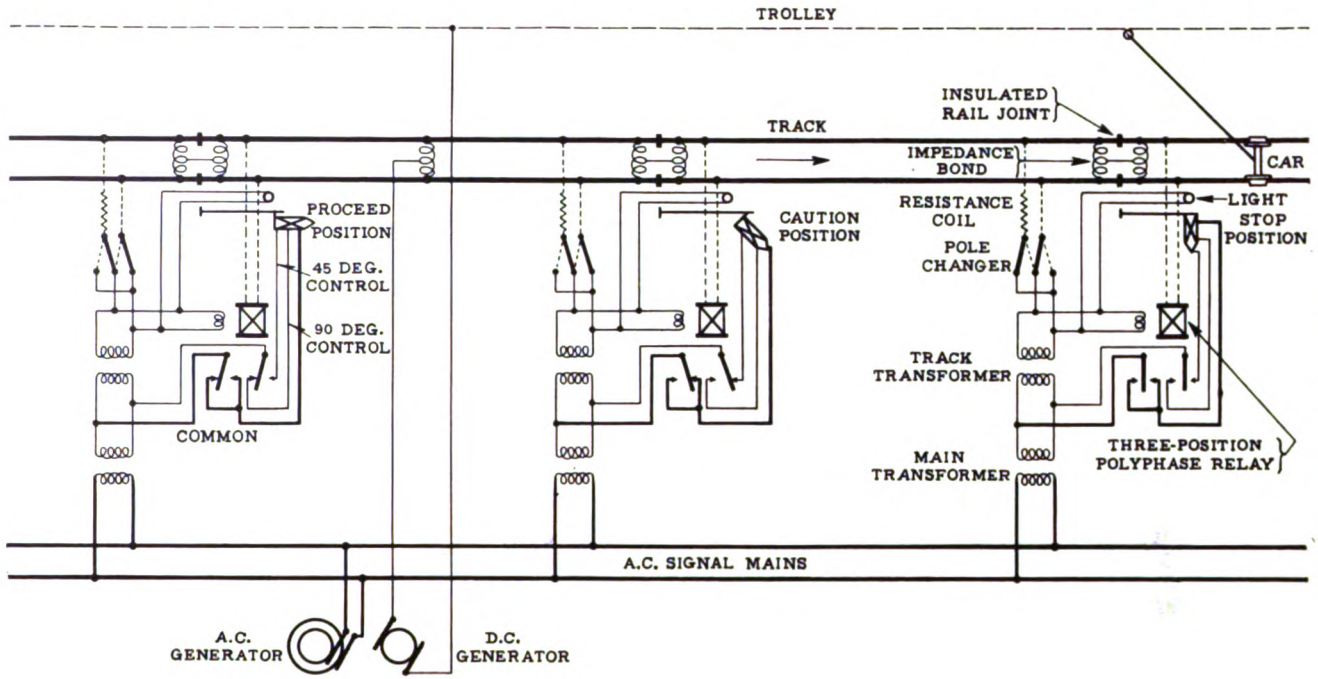

Fig. 18. Typical Circuits for Style "T-2" A. C. Signals Used in Automatic Block Signaling

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Fig. 19. Typical Circuits for Style "T-2" D. C. Signal Controlled by a Lever in an Interlocking Plant.

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Fig. 20. Style "T-2" D. C. Automatic Block Signals on the Canadian Pacific.

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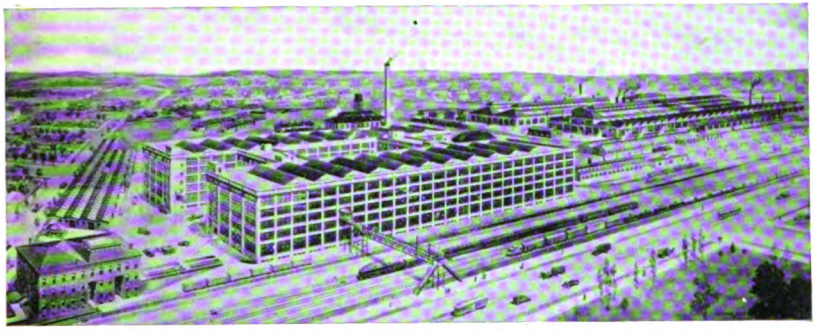

Union Switch & Signal Company

GENERAL OFFICE AND WORKS: SWISSVALE, PENNA.

Floor Space: 919,000 Sq. Ft.

Designers, Manufacturers and Engineer-Constructors of Electro-Pneumatic, Electric, Electro-Mechanical and Mechanical Railway Signal and Interlocking Appliances.

Automatic, Semi-Automatic, and Manually-Operated Block Signals.

Electro-Pneumatic, Electric, Electro-Mechanical, and Mechanical Interlockings.

Automatic Train Control, Highway Crossing Protection.

Railroad, Automobile, and General Forgings and Castings.

Commercial and Engineering Departments prepared to Handle all Problems Arising in the Field of Signal Engineering.

Plans and Estimates on Application.

DISTRICT OFFICES

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Chicago.....Peoples Gas Building
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Represented in Australasia, Argentina and South Africa by the General Electric Company.

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TRADE

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GENERAL OFFICE AND WORKS: SWISSVALE, PA.

DISTRICT OFFICES

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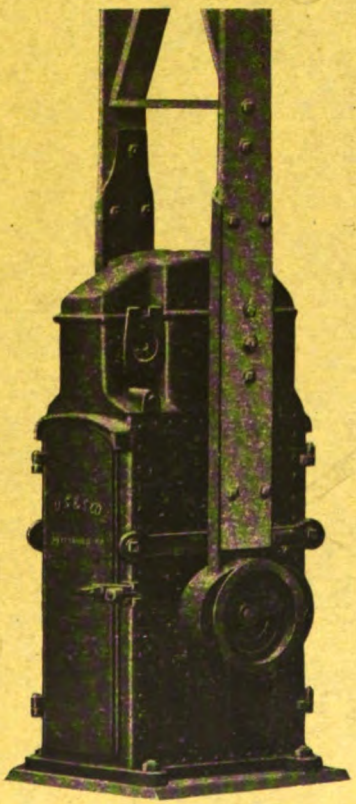
NEW YORK

Peoples Gas Building
CHICAGO

Candler Annex
ATLANTA

Canadian Express Building
MONTREAL

Pacific Building
SAN FRANCISCO



Model 14

Electric Crossing Gate

Bulletin No. 79

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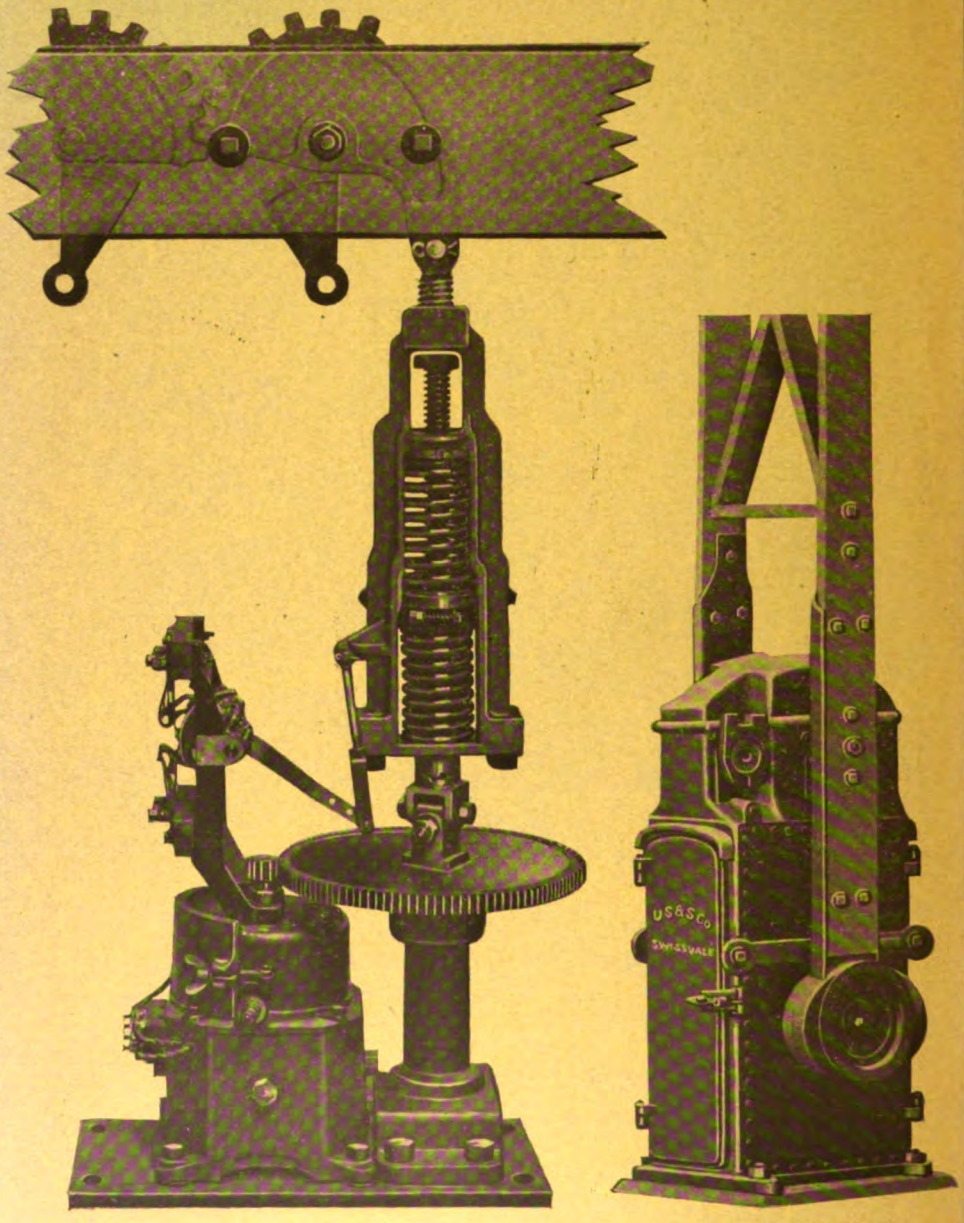

THE UNION ELECTRIC CROSSING GATE
MODEL 14

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THE UNION ELECTRIC CROSSING GATE
MODEL 14

With the rapid increase in the use of electric power, the operation of highway crossing gates by this means is becoming more and more the recognized standard throughout the country. The first electric mechanism to satisfactorily operate highway crossing gates under all conditions was placed on the market by The Union Switch & Signal Company in 1908. Since that date the design has been consistently improved to meet experience gained under service conditions and in accordance with practical suggestions made by the users.

The results are shown in the gate and mechanism illustrated on the opposite page, the principal points of interest of which are as follows:

POST:

The combined post and case has doors at both ends, thus permitting ready access to all parts of the mechanism.

MECHANISM:

The mechanism consists of a motor of ample capacity to raise and lower the gates through a simple gear driven nut and screw transmission, which is provided with a shock absorber in the driving rod. The arms can be instantly stopped or reversed at will in any part of the movement.

CONTROL:

The gate can be controlled by a simple knife switch from any convenient location, or by a lever in an interlocking machine.

CONNECTIONS:

Since the only connections between the operating levers and the gate are three (3) wires, these can in the majority of cases be carried overhead, thus avoiding the necessity of digging up streets for installation and repairs.

OPERATION:

Any number of gates can be controlled from one central point, depending only on the limits of vision.

MOTIVE POWER:

The motor can be furnished to operate with any of the following current: D. C. 110 or 220 Volts. A. C. 110 or 220 Volts, single or three phase, 25 or 60 cycles.

INFORMATION REQUIRED FOR FURNISHING GATES:

1st: A scale plan or sketch with dimensions, showing the location of each gate post, the width of the streets and sidewalks, the angle of the crossing, and the point or points from which the gates are to be controlled.

OR

The number of gate posts required, giving the lengths of street and sidewalk arms for each post, and information as to the method of control, whether by a separate hand switch or by the levers of an interlocking machine.

2nd: The voltage, and if A.C., the phase and frequency of the current available.

3rd: If it is necessary for local reasons to carry the wires under the surface of paved streets, this fact should be stated, giving the nature of the paving.

Estimates and prices furnished on request

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THE UNION SWITCH & SIGNAL CO.
Publishing Department,
Swissvale, Pa.

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The Union Switch & Signal Co.

FOUNDED BY GEO. WESTINGHOUSE 1881

Swissvale, Pa.

GENERAL OFFICE AND WORKS: SWISSVALE, PA.

DISTRICT OFFICES:

Hudson Terminal Bldg.
New York

Peoples Gas Bldg.
Chicago

Railway Exchange Bldg.
St. Louis

Pacific Bldg.
San Francisco

Candler Annex
Atlanta

Canadian Express Bldg.
Montreal

Model 15-A
ELECTRIC CROSSING BELL

Bulletin No. 82.

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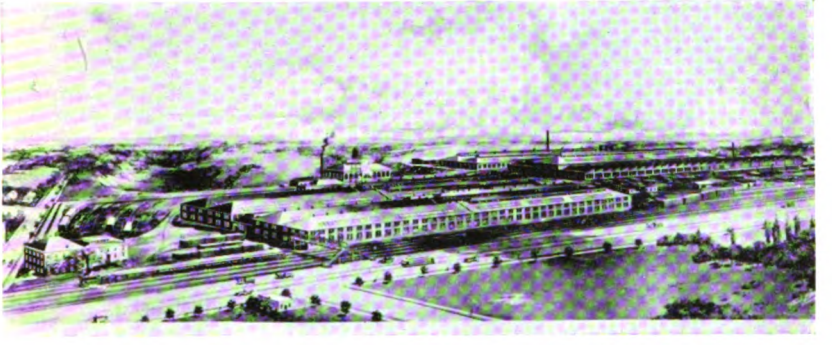
The
Union Switch & Signal Company

FOUNDED BY GEO. WESTINGHOUSE 1881

Swissvale, Pa.



GENERAL OFFICE AND WORKS: SWISSVALE, PA.
Floor Space; 550,251 Sq. Ft. Employees; 3,000.

Owners of the Westinghouse System of Electro-Pneumatic Block Signaling and Interlocking.

Also Designers, Manufacturers and Erectors of Electro-Pneumatic, Electric, Electro-Mechanical, and Purely Mechanical Appliances for Railway Protection.

Automatic, Semi-Automatic and Manually Operated Block Signals.

Electro-Pneumatic, Electric, Electro-Mechanical and Mechanical Interlockings to suit conditions.

Plans and Estimates on Application.

DISTRICT OFFICES:

Hudson Terminal Bldg. New York	Peoples Gas Bldg. Chicago	Railway Exchange Bldg. St. Louis
Pacific Bldg. San Francisco	Candler Annex Atlanta	Canadian Express Bldg. Montreal

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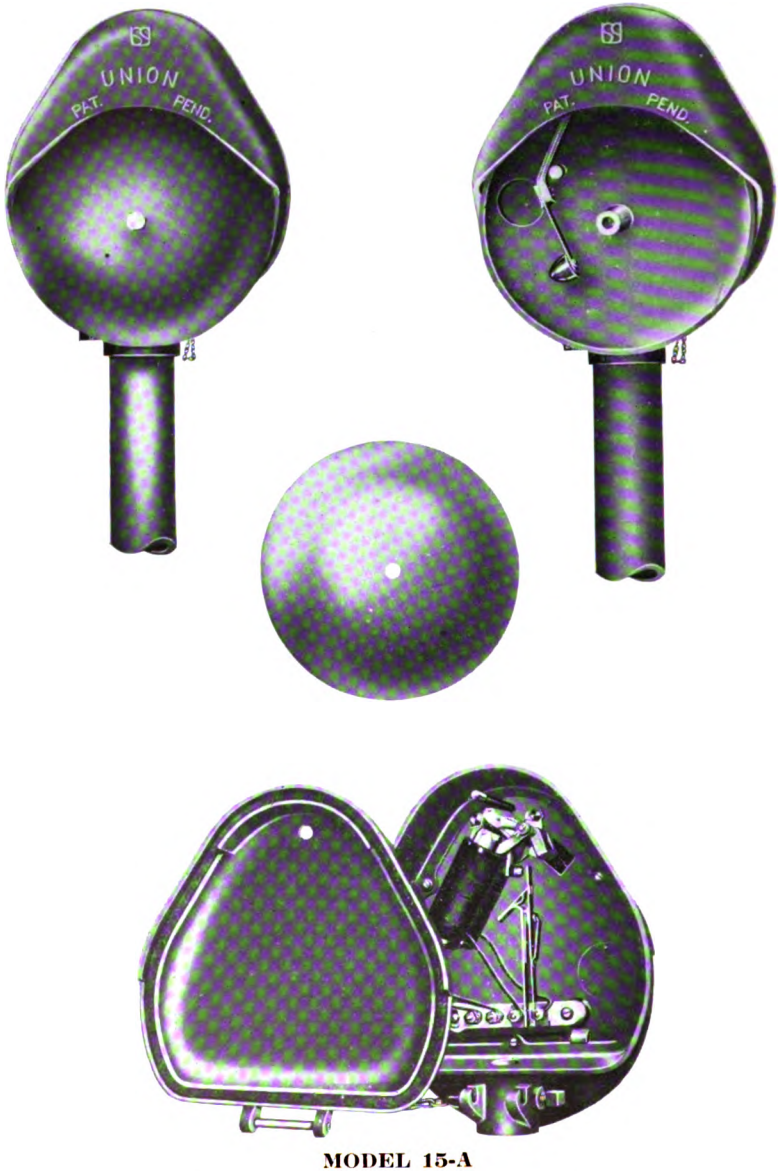

MODEL 15-A

D. C. ELECTRIC CROSSING BELL

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THE UNION SWITCH & SIGNAL CO.

MODEL 15-A D. C. CROSSING BELL

From the accompanying illustrations a clear idea may be had of the construction of the Model 15-A Direct Current Crossing Bell.

The bell is designed to be mounted on top of a three inch iron pipe post as illustrated on the opposite page, or clamped to a pipe post, or mounted on a wooden post, or on the side of a building by means of adapters, illustrated on page 10.

The bell is as near weather proof as possible. The mechanism, with the exception of the tapper and gong, is housed in a cast iron case with an overhanging hood and a bar hinged door which is equipped with hemp packing, making the case when the door is closed water tight; the door is held closed by a stud and nut, which is riveted to the base of the case and projects through the door, and by simply removing the nut the door may be lifted from the hinge lugs, as shown, or where clearance permits let down, as is done with the ordinary hinge. While no means is shown for locking up the mechanism, provision has been made whereby the nut can be replaced by a hasp and padlock lug. The door is chained to the case to prevent it from being accidentally broken by falling.

The tapper, which is mounted outside of the case on a shaft which extends through the case and is operated by the armature, is protected by the gong which is mounted on a stud projecting from the case and is held in place by a cap screw. The gong is protected by the hood which overhangs a portion of the gong, preventing water from leaking in and forming ice between the gong and the case.

By referring to the illustration on page 6, showing a back view of the bell with the cover removed, exposing the mech-

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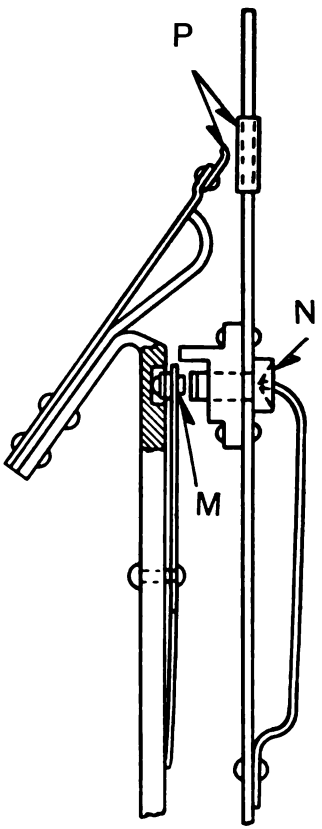
anism, it will be seen that all operating parts, except the tapper, are accessible and can be readily removed; the tapper can be seen and adjusted by shifting the metal disc which is just above and to the right of the circuit controller. The circuit controller which is mounted on a porcelain terminal base can be adjusted by simply shifting the left hand end of the porcelain base without opening the circuit, or it can be readily removed and a new one submitted.



To protect the service contact "P" (which is made of silver, and has relatively large area and makes a sliding contact, and capable of maintaining a very low resistance) from arking or burning, the most serious trouble experienced with crossing bells, removable arking tips M N, made of a special alloy, similar to that used for ignition or magneto work are provided. As it is not important that these contacts maintain a very low resistance they are especially designed for maximum wear. If they should become badly burned, they can be removed and replaced by new arcing tips within a fraction of a minute, without changing the adjustment of the circuit controller.

Magnets are wound to 10 ohms and to operate normally on 6 volts, but will operate on a minimum of 3 volts. In this, as well as in all other respects, the bell meets the requirements of the R. S. A. specifications. Magnets can be wound, however, to suit purchasers requirements.

The bell operates about 160 strokes per minute at normal voltage, but the number of strokes may be increased or diminished to suit local conditions, by shifting the circuit controller. The diminishing of the number of strokes of the bell is a point in its favor as it causes less annoyance and at the

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same time can be heard a greater distance than the more rapid vibrating bells. The majority of the crossing bells on the market, especially those of the ordinary vibrating type, operate at normal voltage between 300 and 400 strokes per minute.

All insulatings will stand 5000 volts. There is spare room in the case for extra terminals, lightning arresters, etc., if required.

The detail parts of this bell are shown on page 8. It will be noted that the parts are relatively few and simple.

All parts are made especially rugged to withstand heavy service.

All iron parts in the magnetic circuit are carefully sherardized to protect them from rusting.

Should the state law require a sign in addition to the bell at highways, it is an easy matter to apply either of the signs illustrated on page 14 to the 3″ post.

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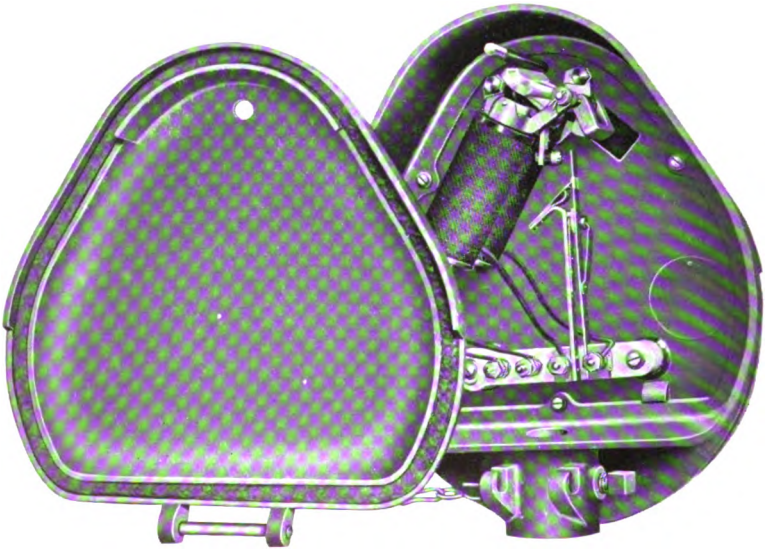

A

MODEL 15-A
D. C. CROSSING BELL

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MODEL 15-A
D. C. CROSSING BELL

Order by Name, Plate and Letter

The drawing reference is shown merely for convenience in checking material with shipping list and invoice.

Fig.		Drawing Reference	List Price
A	D. C. Crossing Bell, complete as shown.....	1-C-8807	$40 00

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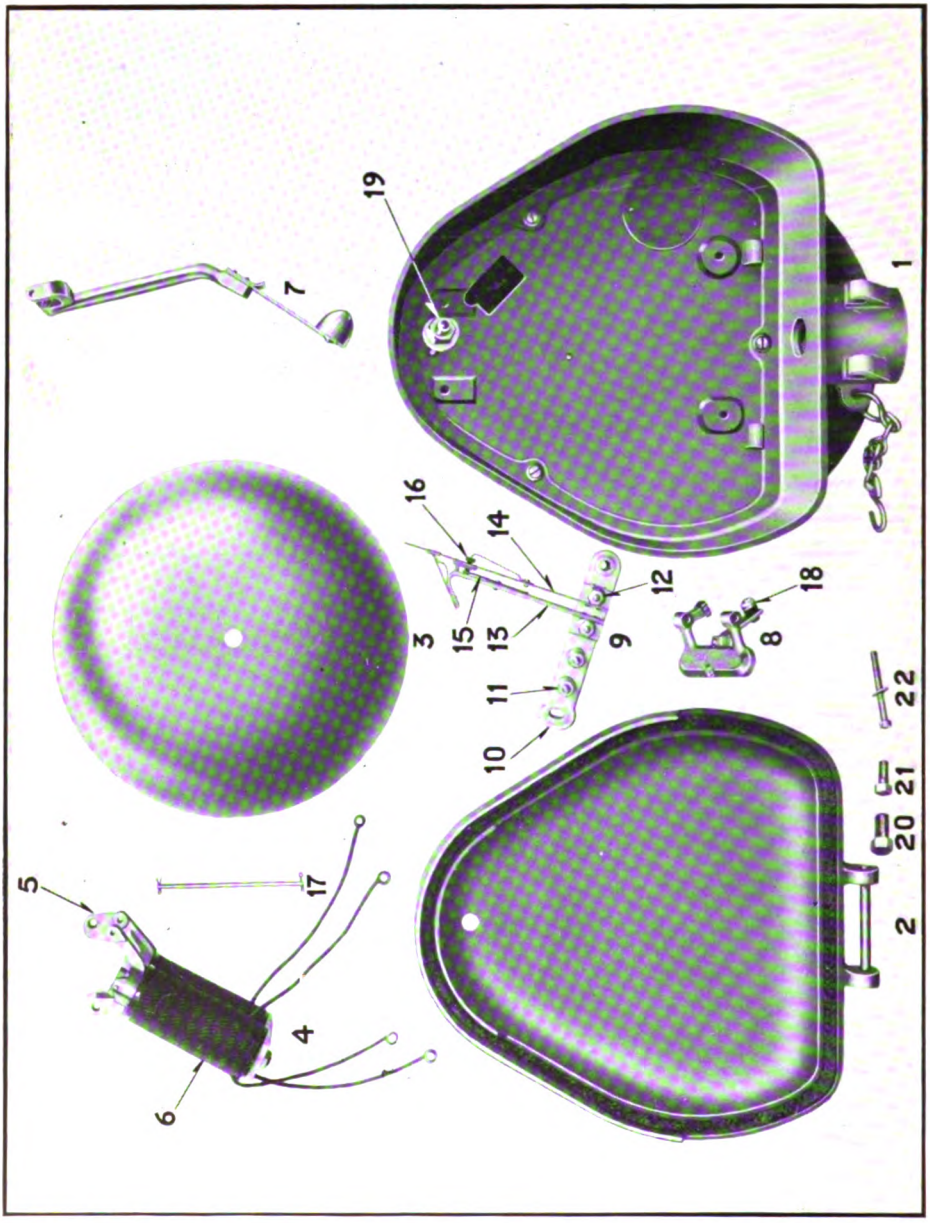

MODEL 15-A. D. C. CROSSING BELL, DETAIL PARTS

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MODEL 15-A

D. C. CROSSING BELL. DETAIL PARTS

Order by Name, Plate and Figure

The drawing references are shown merely for convenience in checking material with shipping lists and invoices.

Fig.		Drawing Reference	List Price
1	Box and Mechanism Plate, C. I. Pat. Nos. 23396 and 23397, with shields, pins, stud, nut, set screw, machine screw and chain	2-3-C-8808	$ 8 10
2	Cover, C. I. Pat. No. 23402, with pin and flax packing	1-C-8808	2 40
3	Gong only	9-B-8379	3 45
4	Magnet Bracket, with cores, stud, pins, backstrap, nuts and magnets, as shown (10-ohms per pair unless otherwise specified), (1-5, 2-6)		14 70
5	Magnet Bracket, with cores, stud, pins, backstrap and nuts, (without magnets)	199-8075	6 50
6	Magnet Coil, with leads and terminals, (5-ohms, unless otherwise specified)		4 10
7	Clapper Arm, C. I. Pat. No. 23384, with clapper, as shown	7-11-C-8808	80
8	Armature, C. I. Pat. No. 23408, with studs, washers, lock washers and hex. nuts, as shown	256-8157	2 15
9	Terminal Board, with terminal posts and contact springs, as shown	384-9968	6 40
10	Terminal Board only	381-9968	40
11	Terminal Post, with three washers, one hex. nut and two lock nuts	711-8094	20
12	Terminal Post, with three washers and three hex. nuts	709-8094	18
13	Contact Spring	1529-8385	3 20
14	Contact Spring	1530-8385	2 00
15	Contact Tip, for contact spring, Fig. 13	1529-F-8385	1 85
16	Contact Tip, for contact spring, Fig. 14	358-8341	80
17	Pin, No. 12 x 5-1/16", with two 1/16" x ⅜" cotters	749-8097	25
18	Stud, with hex. nut and nut lock washer	527-8095	35
19	Hex. Nut, C. B. Pat. No. 23454, for retaining cover to box	154-8082	15
20	Special Tap Bolt, ½" x 1⅛", sherardized, for attaching gong	*26-C-7377	35
21	Cap Screw, 5/16" x ⅞", sherardized, for attaching magnet bracket, Fig. 5 to mechanism plate		05
22	Mach. Screw, fil. hd., No. 14-24 x 2⅛", with washer, sherardized	1-7824	02

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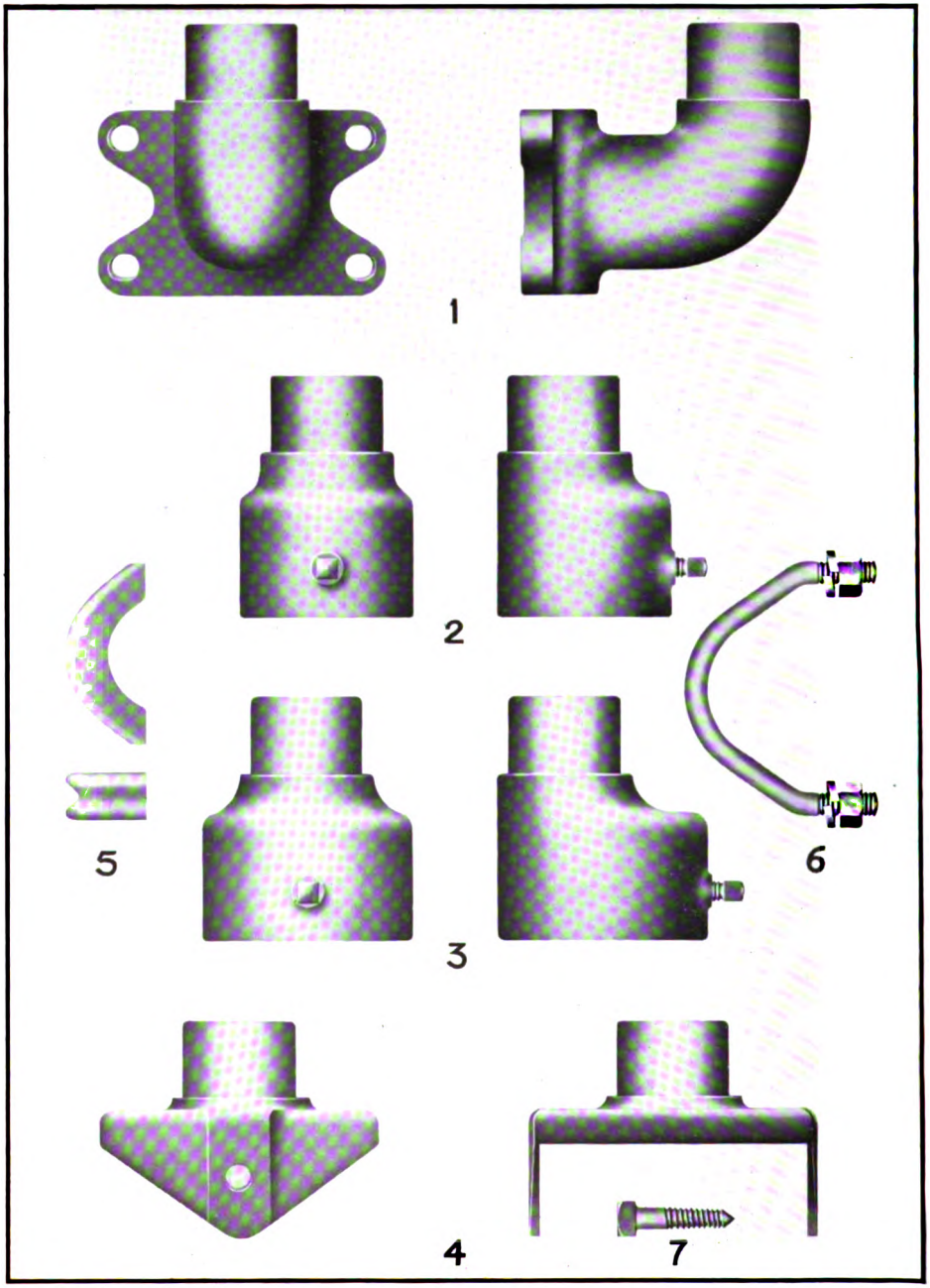

BRACKET AND SOCKETS
FOR MODEL 15-A D. C. CROSSING BELL

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THE UNION SWITCH & SIGNAL CO.

BRACKET AND SOCKETS
FOR MODEL 15-A D. C. CROSSING BELL

The bracket and sockets listed below are for adapting the Model 15-A D. C. Crossing bell to existing posts or to the side of a building.

Order by Name, Plate and Figure

The drawing references are shown merely for convenience in checking material with shipping lists and invoices.

Fig.		Drawing Reference	List Price
1	Bracket only, C. I. Pat. No. 23568, for mounting on the side of a building or square post	67-C-6041	$ 2 45
1a	as above, with fillers, U bolts, lock washers and hex. nuts, for mounting on the side of a 3" pipe post, (1-1, 2-5, 2-6)		3 65
1b	as above, with U bolts, lock washers and hex. nuts, for mounting on the side of a 4" pipe post, (1-1, 2-6)		3 15
1c	as above, with U bolts, lock washers and hex. nuts, for mounting on the side of a 5" pipe post, (1-1, 2-6a)		3 15
1d	as above, with U bolts, lock washers and hex. nuts, for mounting on the side of a 6" pipe post, (1-1, 2-6b)		3 15
2	Socket, C. I. Pat. No. 23566, with one 5/8" x 1" cupped point set screw, for mounting on top of a 4" pipe post	65-C-6041	1 80
3	Socket, C. I. Pat. No. 23567, with one 5/8" x 1" cupped point set screw, for mounting on top of a 5" pipe post	66-C-6041	1 95
4	Socket only, C. I. Pat. No. 23569, for mounting on top of an 8" square wood post	80-C-6041	1 70
4a	as above, with two 3/4" x 3" lag screws, (1-4, 2-7)		1 86
5	Filler only, C. I. Pat. No. 21510, for use with U bolt, Fig. 6, for applying bracket, Fig. 1, to the side of a 3" pipe post	10-C-8034	25
6	U bolt, with two 3/4" lock washers and two 3/4" hex. nuts, for 3" pipe, when used with filler, Fig. 5, or 4" pipe without filler	102-8782	35
6a	as above, for 5" pipe post	66-8782	35
6b	as above, for 6" pipe post	69-8782	35
7	Lag Screw only, 3/4" x 4"		08

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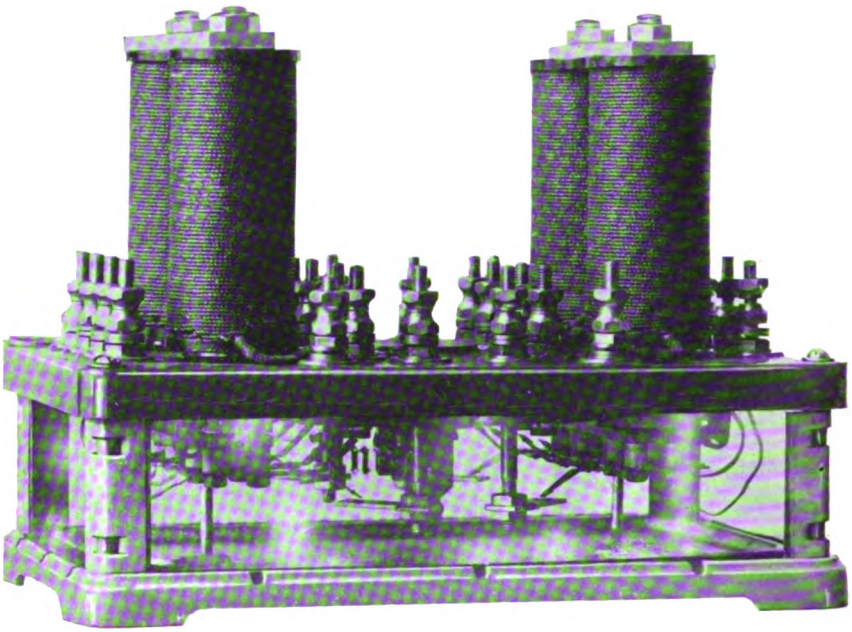

DIRECT CURRENT ENCLOSED INTERLOCKING RELAY
MODEL 12

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DIRECT CURRENT ENCLOSED INTERLOCKING RELAY
MODEL 12

The top plate of this relay is made in one piece of insulating material, therefore bushings are dispensed with: The pole pieces, locking pawl, and contact posts are rigidly fixed to the top plate. All terminal posts and insulations conform to R. S. A. standards. The magnet coils may be removed without affecting the adjustment of the relay.

A wire tail is attached to the base plate for convenience in conveying the relay by hand, and can be folded under the relay when in service.

Order by Name, Plate and Figure

The drawing references are shown merely for convenience in checking material with shipping lists and invoices.

Fig.		Drawing Reference	List Price
A	Direct Current Enclosed Interlocking Relay; two front and two back contacts, for each pair of magnets	2-C-8121	$60 00
B	Direct Current Enclosed Interlocking Relay; four front and no back contacts, for each pair of magnets	3-C-8121	60 00
C	Direct Current Enclosed Interlocking Relay; no front and four back contacts, for each pair of magnets	4-C-8121	60 00
D	Direct Current Enclosed Interlocking Relay; four front and two back contacts, for each pair of magnets	5-C-8121	62 50
E	Direct Current Enclosed Interlocking Relay; two front and no back contacts, for each pair of magnets	6-C-8121	53 75
F	Direct Current Enclosed Interlocking Relay; no front and two back contacts, for each pair of magnets	7-C-8121	53 75

NOTE:—In addition to the above, any combination not requiring more than four springs or six contacts on each side can be furnished. Prices on application.

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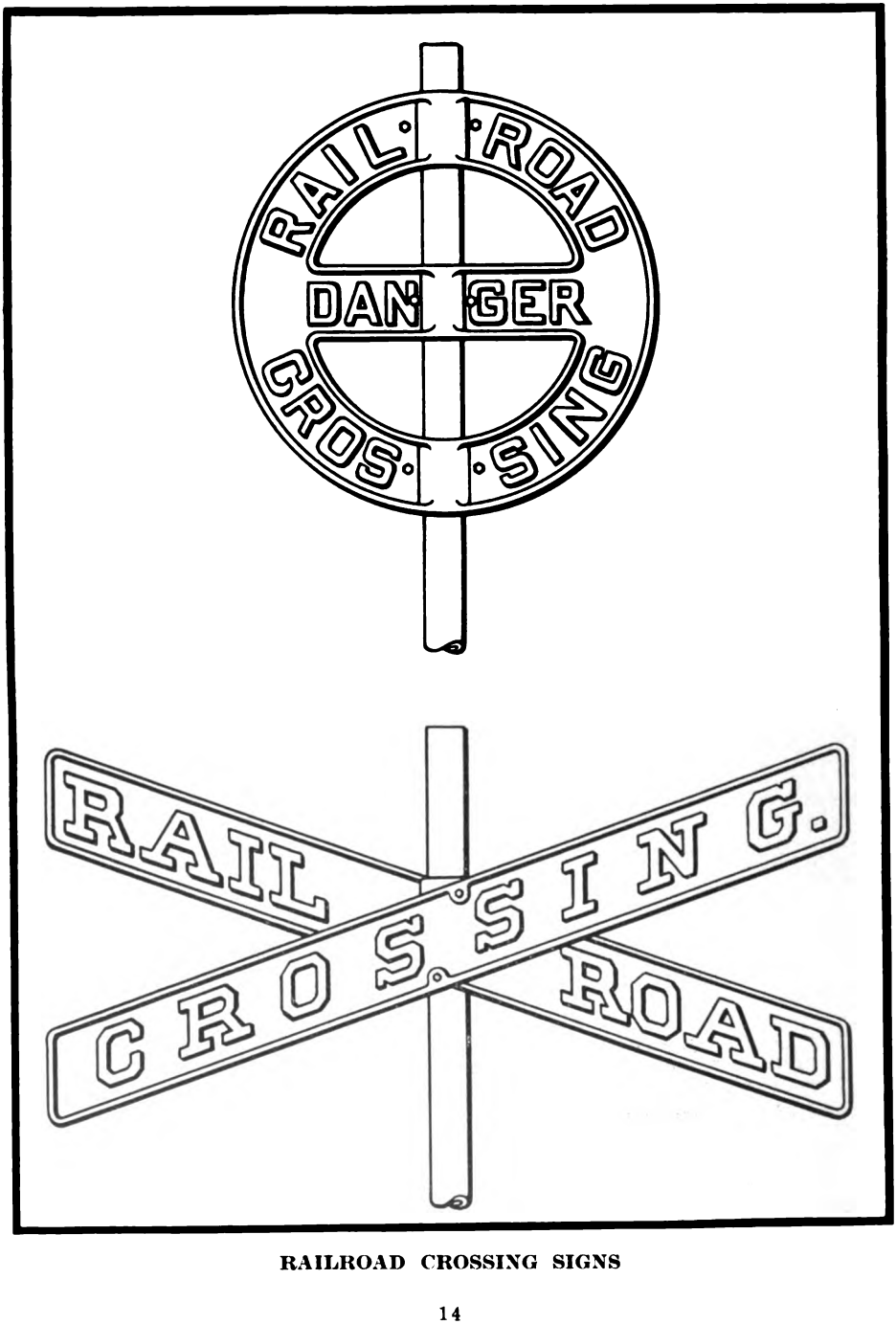

RAILROAD CROSSING SIGNS

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RAILROAD CROSSING SIGNS

Order by Name, Plate and Figure

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Fig.		Drawing Reference	List Price
A	Circular Sign, with bolts and nuts, for fastening sign to post	1-C-5844	$14 70
B	Cross Sign, with bolts and nuts, for fastening sign to post	12-C-5844	17 20

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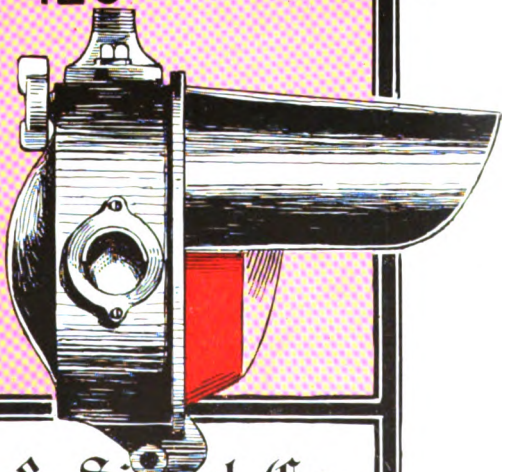
New HC-5 Highway Crossing Signal

BULLETIN No. 120



Union Switch & Signal Co.
SWISSVALE, PENNSYLVANIA

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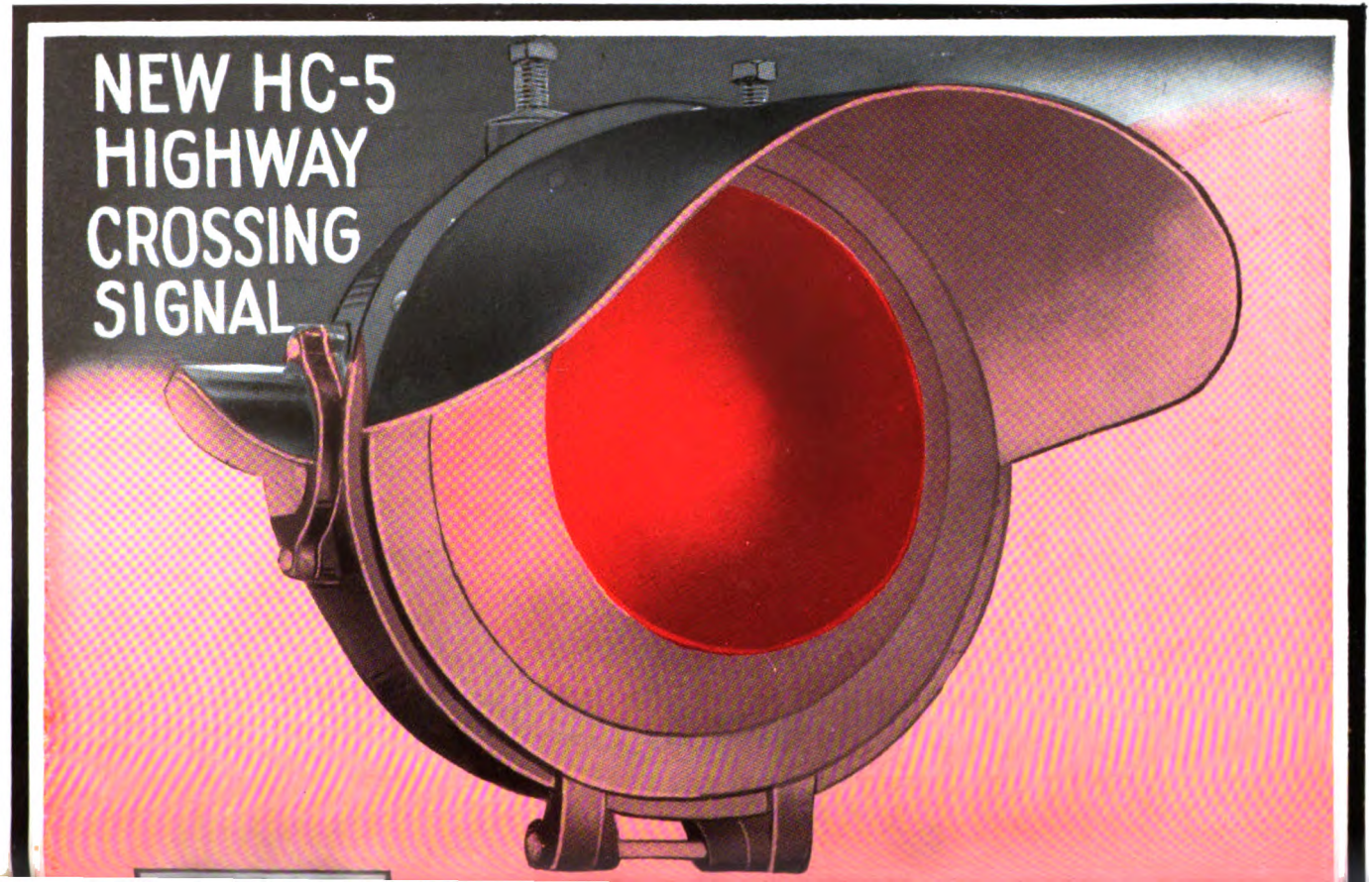

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Angles

ARA ASSEMBLY

Long Range
Close-up Indication
160° Horizontal Spread

Specify the Union Style HC-5
Highway Crossing Signal

TRADE MARK

Union Switch & Signal Co.

SWISSVALE, PA.

TRADE MARK

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FEATURES of the Union Style HC-5 Signal, in addition to the distinctive long range and close-up indications, are:

(a) Use of S-11 bulb; lamp fitted in single contact bayonet candelabra lamp base.

(b) Side lights enabling check observation being made from trains.

(c) Lamp adjustments easily established and maintained.

(d) Rugged construction promoting longer life.

(e) Small number of parts and consequent accessibility.

Ordering References

Style HC-5 Color Light Highway Crossing Signal, two lights complete with 1¼-in. supporting arm for mounting on 3-in. mast. Pc. No. 148007, Dwg. B-8912, Sh. 37.

When ordering specify size of mast and lamp voltage if for other than 11-volt, 11-watt, lamp as included in the above reference.

If the signal is required complete with mast and auxiliary fittings, specify assembly desired as in Plate K-108 of our Highway Protective Device Catalog.

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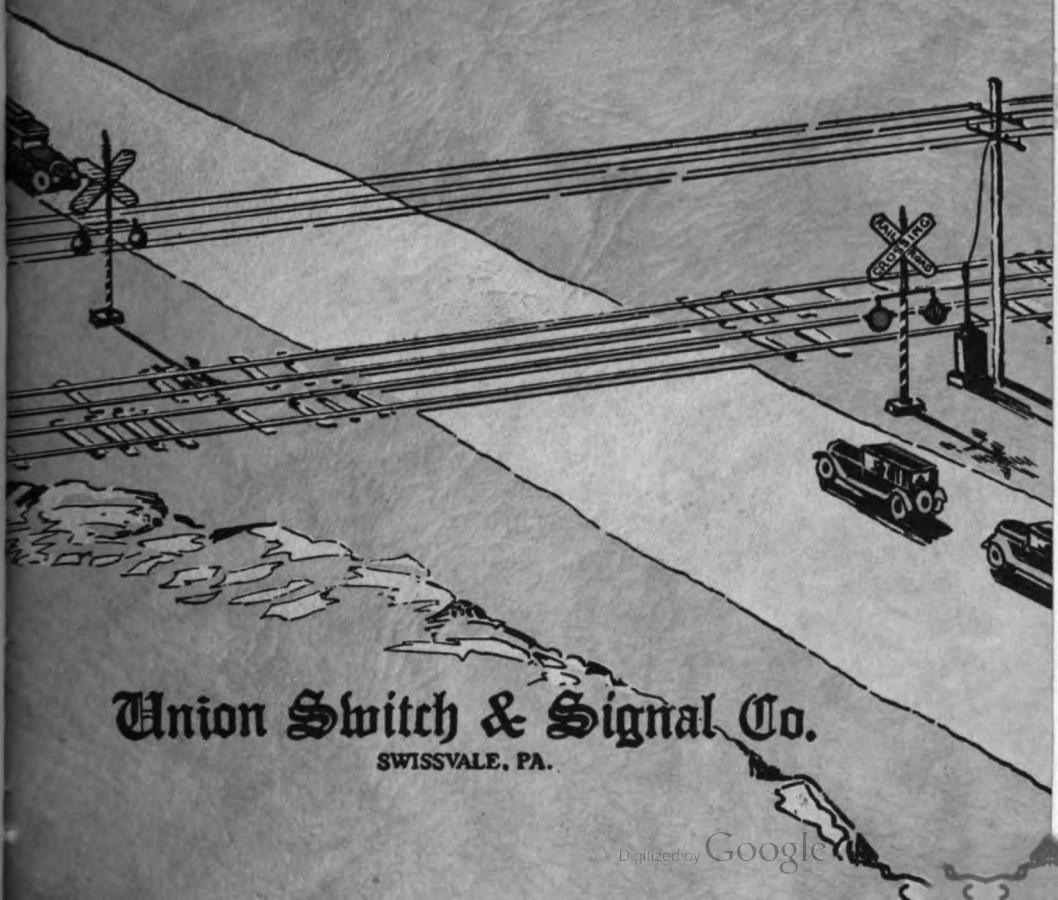
Union

PROTECTION at Highway Crossings

Bulletin No. 125



Union Switch & Signal Co.
SWISSVALE, PA.

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Protection

at

Highway Crossings

BULLETIN 125
February, 1929

Union Switch & Signal Company
SWISSVALE, PA.

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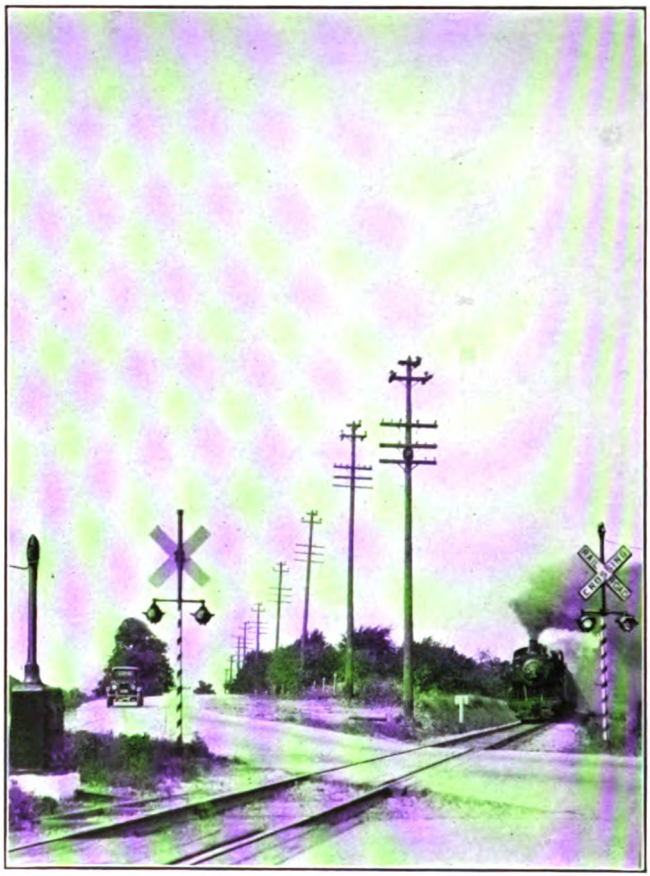

Style HC-5 Highway Crossing Flashing Light Signals—P.M. Ry.

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FOREWORD

A broader application of Highway Crossing Protection to present day needs has caused the development of new and improved devices to meet each emergency. The Union Switch & Signal Company, from the time of the first track circuit, has produced complete systems which have served progressively to fulfill the highest standards of Highway Crossing Protection for each period of advancement arising from ever increasing requirements.

While this bulletin deals mainly with the new "Union" Style HC-5 Color Flashing Light Signal, other designs and accessories are described. An effort is also made to present general information which may be useful and of interest.

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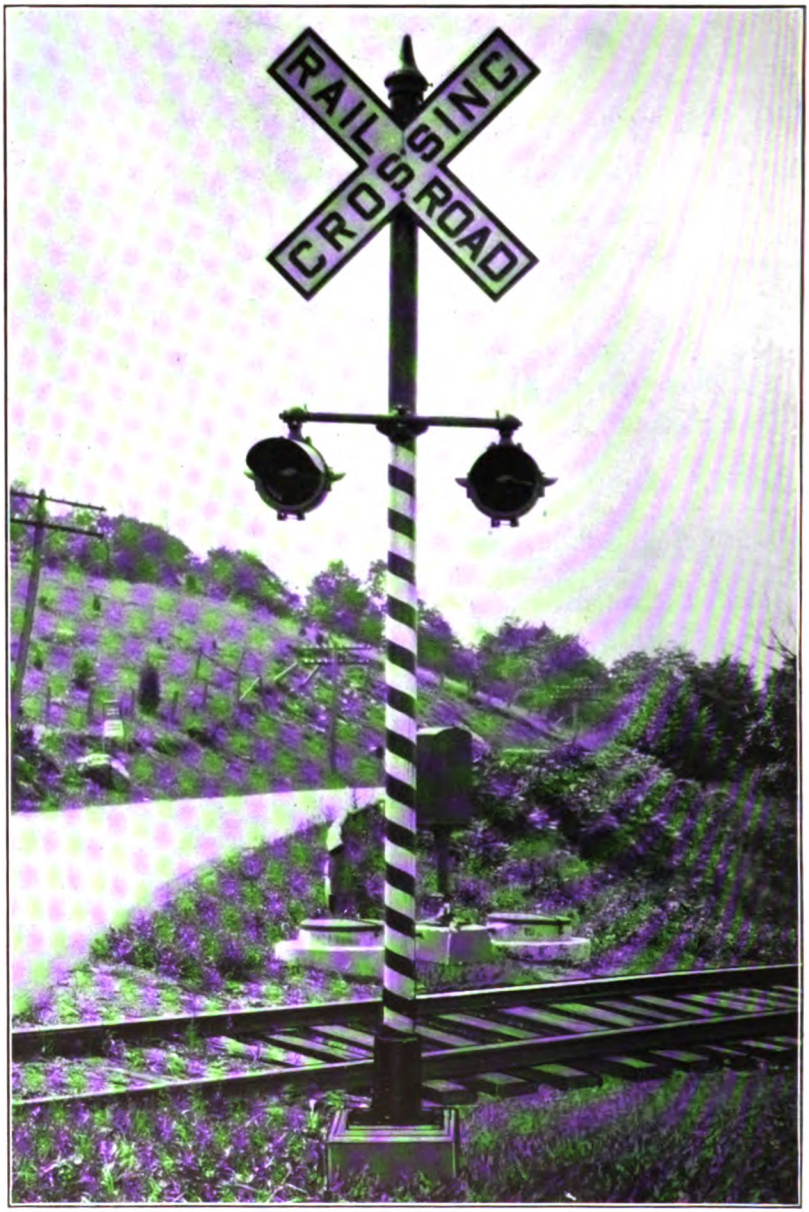

Style HC-5 Signal on Branch Line of Erie R. R.

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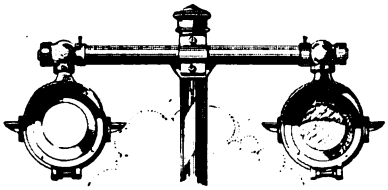

Highway Crossing Protection

SINCE grade elimination at highway and railway crossings cannot reasonably be accomplished for many years, railroad and constituted state or local authorities must look to present day means to secure adequate protection. Manually protected and watchmen-staffed crossings are expensive to maintain, and subject to deficiencies of the human element. The present tendency is therefore towards the use of an automatic signal of either the color flashing-light or flagman type.

The exacting requirements call for refinements in design and manufacture which can only be achieved by a large and experienced organization. The positive nature of the highway signal indication or aspect is of prime importance; but of equal or greater importance is the construction and principles of its controlling apparatus, and an uninterrupted supply of electrical energy.

The Union Switch & Signal Company has served the needs of Railway Signaling for half a century and the keynote in the design of all its equipment has been "Safety and Reliability of Operation." Union products not only are the most highly developed individual elements, but form the most satisfactory combination of elements entering into a complete and comprehensive system.

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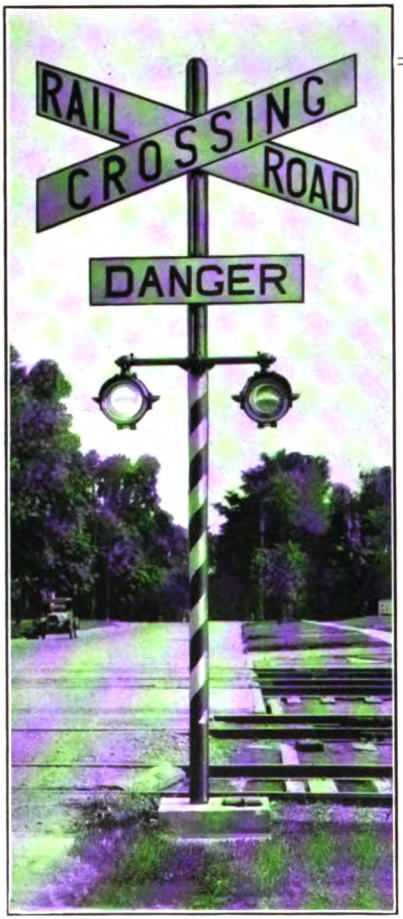

At left—Style HC-5 Signal on P. R. R.

At right—Style HC-5 Signal with HC-42 "Stop" Sign on Wabash R. R.

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The Type of Signal

There is a variety of dependable "Union" Highway Crossing Protective Devices described and illustrated in this pamphlet. Lest confusion be created in the mind of the reader, it should be understood that while there is sometimes a choice between "Union" designs which accomplish the same ends, there is usually a logical process of selecting the elements of the system, based upon the practice of the individual railway and the type of electrical power supply available.

Questions which will assist in the determination of the specific type of equipment are listed on page 38. On page 35 is a graph from which the length of approach track circuit may be obtained. Pages 24 to 34 show and describe typical wiring diagrams covering a variety of combinations of equipment used. Detail description of crossing signals and auxiliary apparatus as well as ordering references are given.

"Union" Highway Crossing Signals are of two general types, (1) Style DW (three-aspect) Automatic Flagman with swinging warning arm and light, with or without a bell; (2) Flashing Light Signals, various designs with or without a bell. It is the purpose of this bulletin to describe the "Union" Style HC-5 Flashing Light Signal recently developed, immediately popular and extensively installed.

Style HC-5 Flashing Light Signal

The unusual range and spread of the light indication are outstanding features of the HC-5 Signal. These features make the HC-5 Signal broadly applicable not only to all locational arrangements of highway approaches, but also cause it to meet the requirements of various railways on which different acceptable limitations prevail. The "Union" Style HC-5 Signal therefore may be said to have "Universal application."

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Crossing Protected with Style HC-5 Flashing Light Signals—P. R. R.

Assembly

The usual assembly of the Style HC-5 Signal consists of two light units suspended from the ends of a pipe cross arm which is clamped to a pipe post. The standard spacing between units is 2′ 6″. The light units screw into "T" connections on the ends of the cross pipe, thus providing for horizontal and vertical alignment, and are then made secure by set screws. Pipe plugs in the ends of "T" connections may be removed to assist in wiring the unit. An intermediate bolted connection is placed between the light unit and the "T" connection, making it possible to assemble the unit without twisting the wires. This signal may be used in combination with a cross buck warning sign, an illuminated "STOP" sign, a crossing bell, and an instrument case as the nature of the installation requires.

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Crossing Protected with Style HC-5 Flashing Light Signals—Erie R. R.

Light Unit

The main feature of the HC-5 Signal is the optical system. A very large percentage of the lamp candle power is utilized by an efficient and durable reflector placed behind the bulb.

The lens is new and novel, in that it provides for a reliable horizontal indication spread of 160°. The semi-conical shape of the glass provides the means for placing prismatic rings on the inner surface of the straight sides which collect light from the lamp bulb and diffract it in such a manner that a positive indication is given close in front of or at one side of the signal. The main beam, is determined by the pattern on the front convex portion of the lens. This lens is designed so that a strong beam is projected through a wide angle in a horizontal plane through the axis of the lens. An indication of equal spread is also given over the entire surface of the lens at all points below the horizontal.

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Style HC-5 Signal with Pilot Lights for center of street location. Top left—Light Unit opened. Lower left—Pilot Light.

Light rays passing through the main convex portion of the lens spread out, overlapping the indication from the sides, thus giving a uniform indication when passing from one point of observation to another. The lens is designed with all of the prismatic sections on the interior surface, presenting a smooth exterior, permitting of easy cleaning.

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Special high transmission red glass, meeting A.R.A. requirements for highway crossing signals, is used.

An S-11 single contact bayonet candelabra base lamp is used and can be furnished for practically any voltage and wattage desired up to approximately 25 watts. The lamp recommended is rated at 11 volts, 11 watts.

The lamp receptacle is supported by a cast metal bracket suitably insulated from the housing to withstand 3,000 volts. Standard A.R.A. terminals are used for making wire connections. Lamp receptacles are located accurately in our factory, the socket being secured permanently in position. No new adjustments need be made to secure the proper alignment, if $\frac{1}{64}$" precision lamps are used for replacements.

Lens Housing and Hood

The housing for the lens unit is a two piece cast iron case hinged together so that when opened, wire connections and lamp renewals can be easily made. A means is provided so that the unit may be locked if desired. Units are equipped with side lights, but these can readily be covered with blank plates if not desired.

Hoods which shield the lens from direct sunlight are adjustable. A multiple arrangement of holes permits the hoods to be rotated and secured so that there may be no obstruction of the indication to the observer on the highway. Both the housing and the hood are finished with a durable, black, baked enamel.

Pilot Lights

For center of street locations, there is available a very efficient pilot light and terminal box assembly illustrated on the opposite page. Steady red lights warn those on the highway of the existing obstruction; but lamps are shielded to exclude observation from the trackway.

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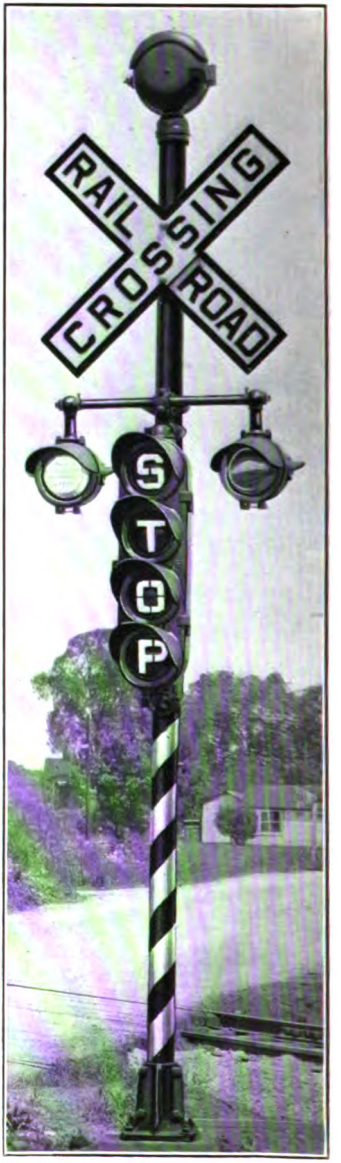
Stop Sign

An illuminated "STOP" sign illustrated on this page is extensively used in connection with the Style HC-5 Signal, but may be applied equally as well to other types. The "STOP" sign consists of four (4) light units assembled vertically in a single, cast iron case.

Each unit is fitted with a $\frac{1}{6}\frac{1}{4}''$ precision 11 volt 11 watt bulb, the socket of which is accurately located with respect to a glass reflector. Between the lens and lamp bulb of each unit is an opaque mask in which one of the letters in "STOP" is left open. All lenses appear dark normally. Upon the approach of a train the lamps are illumined and a distinctive "STOP" warning is displayed in bright red letters. This signal is known as the Style HC-42 illuminated "STOP" sign; details and ordering references are shown in Catalog Plate K-130.



Style HC-5 Signal with Style HC-42 "Stop" Sign Indianapolis Union Ry.

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Style "DW" Automatic Flagmen on D. L. & W. R. R.

Style DW Automatic Flagman

An arrestive indication is displayed by the Union Style DW Automatic Flagman. The mechanism is of the magnetically operated type, substantially constructed and provides three indications, viz., "Stop" (arm swinging), "Clear" (arm held behind shield), and "Out of Order" (arm stationary, suspended vertically). This signal is supplied for operation on either direct or alternating current and may readily be used in combination with bells, crossing signs, or other required attachments. Bulletin No. 86 describes this type of signal and complete catalog references are given on Plates K-1 to K-51 of our 1924 catalog.

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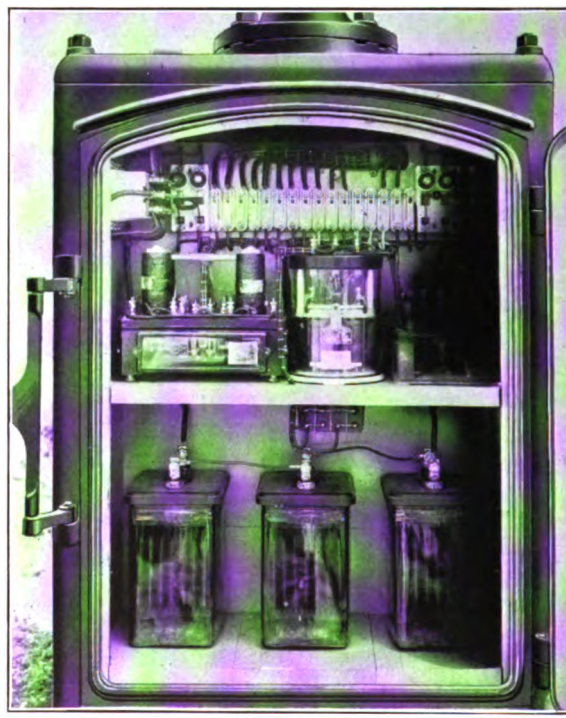
Auxiliary Equipment

The track circuit is the basis of crossing signal control and of necessity relays are imposed between it and the signal proper. How many and of what type, depends on conditions and standards existing. Important controlling devices commonly employed are briefly described and illustrated in following pages. References to our catalog are made also, so that specific ordering information may be available.



Front Compartment of Instrument Case showing Style "NF" Flasher Relay and Interlocking Relay

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Style DX-13 Interlocking Relay
Size 6½" x 12½" x 8½" high
(including springs)

Model 16 a-c. Interlocking Relay. See Catalog Plate E-1100. Size 11¾" x 6½" x 10⅜" high

Interlocking Relays

Interlocking relays of the types shown are used to control warning signals on the approach of trains from either direction on single track railroads and, as is often the case, on double or multiple track roads. Such relays function to discontinue the warning after the train has passed the crossing. (See diagrams Figs. 15 and 16).

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Model 13 Neutral Relay
See Catalog Plate E-4810
Size 7" dia. x 8⅞" high

Style DN-11 Neutral Relay
See Catalog Plate E-4900
Size 6¼" sq. x 8" high

Style SLV-13 Vane Relay
See Catalog Plate E-1005
Size 8" dia. x 10" high

Model 15 Vane Relay
See Catalog Plate E-1020
Size 9" wide x 10" deep
x 10½" high

Track and Line Relays

Track Relays of the types illustrated are used when ruling train traffic is in one direction only. These relays also have a very extensive application in Railway Signaling practice.

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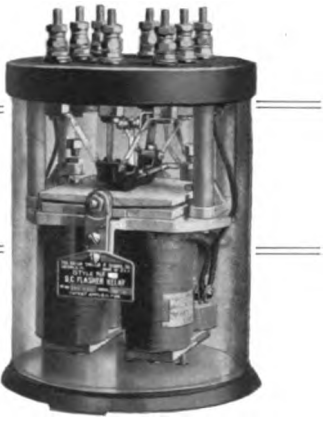
Style "NF" d-c. Flasher Relay
See Catalog Plate E-5050
Size 7" dia. x 10⅛" high



Flasher Relays

The Union Style NF Relay, due to its rugged construction, simple operating principle and dependability, is highly recommended to control the alternate flashing of all types of Flashing Light Signals. Unless otherwise specified, this relay is adjusted to provide equal time flashing intervals at a rate of from 30 to 35 times each minute.

In the circuit diagrams, Figs. 1, 2, etc., the four coils of the NF Relay are represented, for simplicity, by one coil for each pair. The two pairs of coils are permanently connected in series and a contact actuated by the armature is so connected between the two sets of coils that it shunts out each pair alternately, depending upon the position of the armature. When this relay is de-energized the shunting contact is normally biased to shunt one pair of coils, thus assuring starting action. The relay armature carries two other sets of contacts through which energy is supplied to the signal lamps. These are arranged so that each set opens only in respective extreme positions of the armature. This assures at least one of the lamps in each of the crossing signals being lighted.

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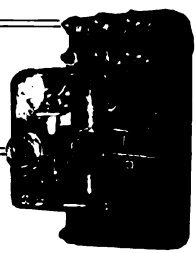
Style SV-31 a-c. Flasher Relay
See Catalog Plate E-1062
Size 10″ wide x 9″
deep x 10½ high

The Style SV-31 Flashing Vane Relay is used where a-c. circuits are employed. The control circuit for the relay is interrupted at equally timed periods by a simple device in the relay itself.

Power Transfer Relay

Since dependability is the essential requisite of any Highway Crossing Protection System, the Union ANL-30 Power Transfer Relay has been developed to transfer inexpensive a-c. power, which may be subject to interruption, to a stand-by source which usually consists of primary battery or trickle charged storage battery.

Style "ANL-30" Power Transfer Relay
See Catalog Plate E-1175
Size 6½″ x 3⅝″ x 3⅜″



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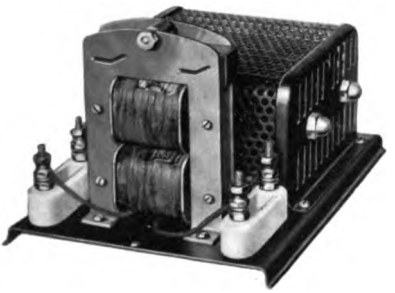
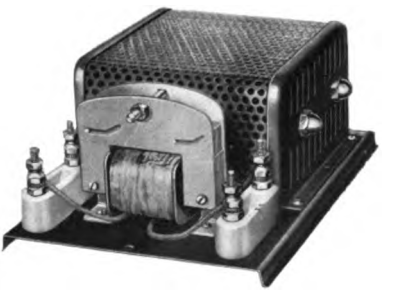
Style RT-10 Rectifier
See Catalog Plate S-4
Size 6½" x 6¾" x 6" high

Style RX-10 Rectifier
See Catalog Plate S-20
Size 6½" x 6¾" x 5" high



Style RT-21 Rectifier
See Catalog Plate S-10
Size 8½" x 11¾" x 7" high



Style RX-21 Rectifier
See Catalog Plate S-25
Size 8½" x 11½" x 5" high

Rectifiers for Battery Charging

In order that an ever ready and economical power can be had when the a-c. supply is not entirely dependable, a complete line of "Union" Rectifiers is available for battery charging purposes. These rectifiers, some of which are shown above, are fully described in Bulletin No. 111 and Section S of our Catalog. A few typical applications are shown in Figs. 1 to 12. Track batteries of the storage type are also kept fully charged by means of Style RT-10 or RX-10 Rectifiers.

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Crossing Bell

Model 15-A Highway Crossing Bells of the type shown have been a standard "Union" product for many years and are made for operation on alternating and direct current. Full information covering the Model 15-A Bells will be found in Catalog Plates K-75 to K-90.

Model 15-A Crossing Bell

Style "W" Transformer Size 4¾" x 7¾" x 9" high

Transformer

The Union Style "W" Transformer is recommended for all types of Railway Signal and Highway Crossing Protection service. The primary voltage may be as high as 575 Volts at commercial frequencies. A maximum of 24 A.R.A. terminals may be used. Multiple secondary windings may be provided.

Other accessory apparatus to Highway Crossing Protection are:

Resistors, Reactors and Impedance Bonds. Section F Catalog
Lightning Arresters..... Section P Catalog

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Circuits

It is impracticable to show more than a few typical circuits for the control of highway crossing signals. Circuits

Rear Compartment of Mechanism Case Housing Interlocking Relay, Style ANL-30 Power Transfer Relay, Style RX-21 Rectifier, etc.

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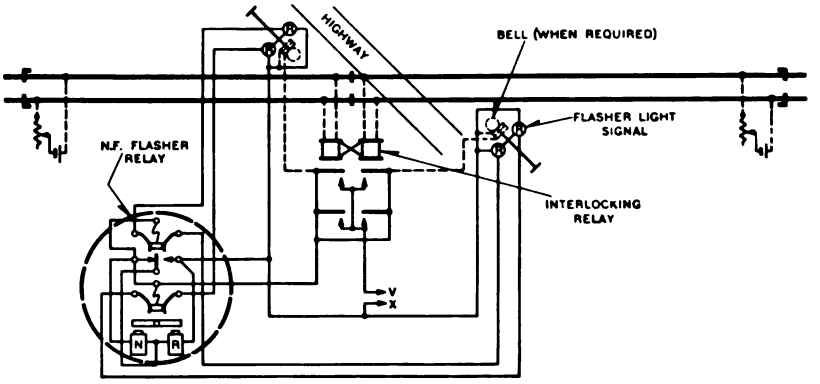


Fig. 1. Circuits for operation of Flashing Light Highway Crossing Signals on single track railroad having d-c. track circuits

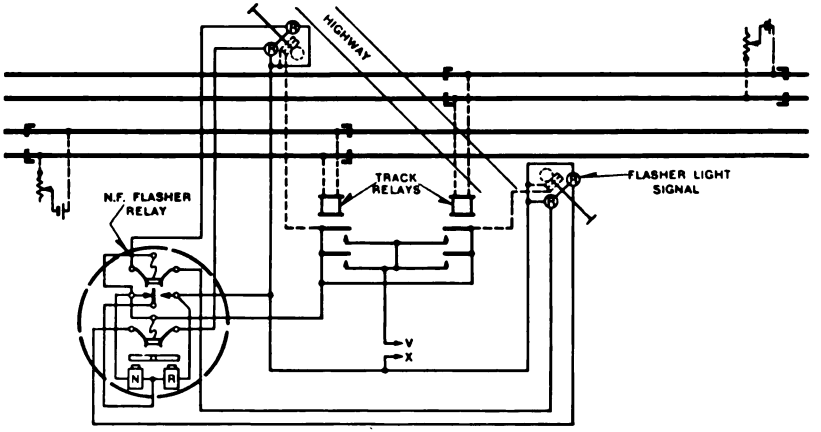
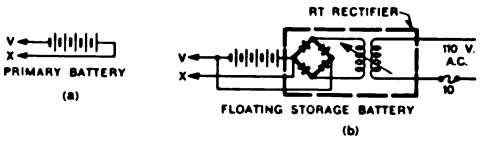


Fig. 2. Circuits for operation of Flashing Light Highway Crossing Signals on double track railroad having d-c. track circuits



Alternative Battery Supplies for Figs. 1 and 2

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shown on the following pages include the basic principles involved and special features may be added or substituted to suit the conditions applying at specific locations. While primary batteries are indicated for feeding d-c. track circuits, storage batteries, trickle charged by rectifiers (see page 21), may be used where there is a suitable a-c. supply.

Single track highway crossing circuits are designed to provide protection for both directions of railroad traffic. Where reverse running on double track is common practice, the track circuit and interlocking relay portions of the single track circuit diagrams may be used in conjunction with double track circuit diagrams.

Bells are optional and circuits for same are shown in dotted lines. The number of bells used at any one crossing depends on local conditions, one is usually sufficient.

A brief description of the individual circuits appears on the page with or opposite each wiring diagram. References are shown on the wiring diagrams for the essential apparatus needed for each complete installation.

The circuits shown are typical and for the sake of simplicity, multiple contacts are not shown. Relays usually have four or more contact fingers and, where extra contacts are available, they may be connected in multiple so as to distribute the current and thus decrease contact resistance.

Circuit Diagrams, Figs. 1 and 2, illustrate simple automatic schemes for highway crossing protection on a single and double track railroad having d-c. track circuits.

Either primary or secondary batteries may be used for the operation of the NF Flasher Relay and the lighting of the signal lamps. Diagram (a) shows a simple primary battery, the leads of which are marked "V" and "X" to correspond with the same references shown in Figs. 1 and 2. Diagram (b) shows a trickle charged storage battery power supply commonly used where an alternating current power line is

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available. The Style RT-10 Rectifier used in this scheme is illustrated and described on page 21.

Circuit Diagrams, Figs. 3 and 4, illustrate operating conditions corresponding with Figs. 1 and 2. They include, however, recent "Union" developments which assure an economical and unfailing supply of power for use in connection with highway crossing protection installations. Each of the schemes shown in Diagrams (a) and (b) can be applied to Figs. 3 and 4, the choice usually depending upon the standard practice employed by the railroad or whether some portion of the equipment is already in service where the installation is to be made. Diagram (a) employes the "Union" ANL-30 Power Transfer Relay, an RX Type Rectifier and a Transformer having a separate secondary winding. Upon failure of the a-c. supply, the Style ANL-30 Relay becomes de-energized and transfers the operating circuits to the stand-by battery. Diagram (b) employes a "Union" Style ANL-30 Power Transfer Relay, an RT type Rectifier and a Transformer with one secondary winding. Ordinarily the Style RT-10 and Style RX-10 Rectifiers have ample capacity for charging batteries at a simple highway crossing. Where additional power is required Style RT-21 and Style RX-21 Rectifiers are recommended.

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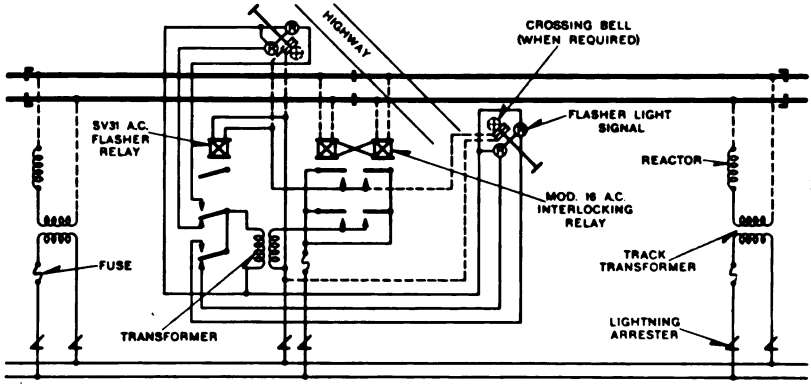

Fig. 5

Circuit Diagrams, Figs. 5 and 6, illustrate simple automatic schemes for highway crossing protection on single and double track steam railroads where alternating current track circuits are in use.

Circuit Diagrams, Figs. 7 and 8, illustrate simple automatic schemes for highway crossing protection on single and double track railways using electric propulsion. In these cases Impedance Bonds (Catalog Section F) are employed

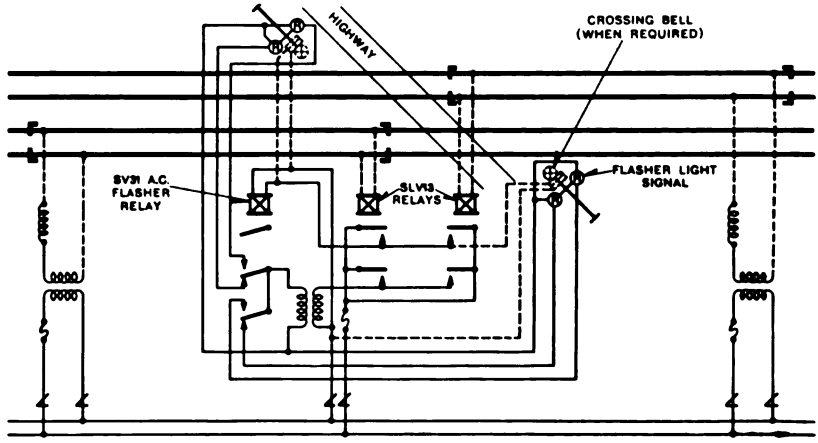

Fig. 6

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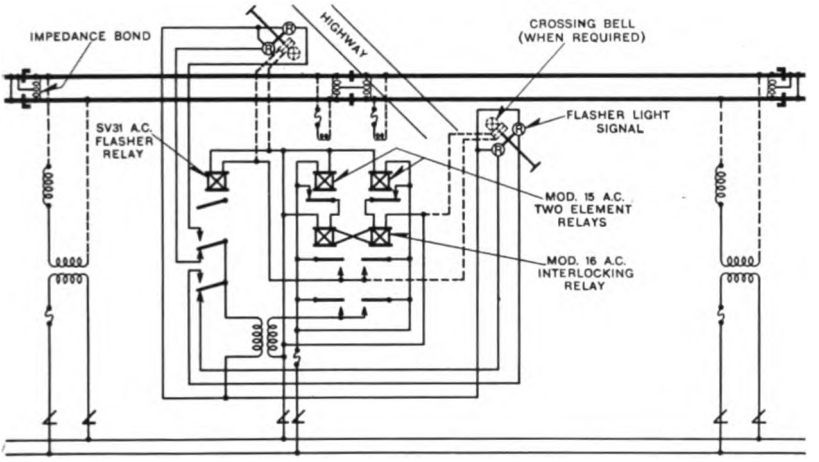

Fig. 7

to permit a flow of propulsion current in both rails, around the insulated joints and at the same time prevent a-c. from passing from one track circuit to that adjacent. Due to the impedance of the bond, the necessary difference of potential between rails for operating track relays is maintained.

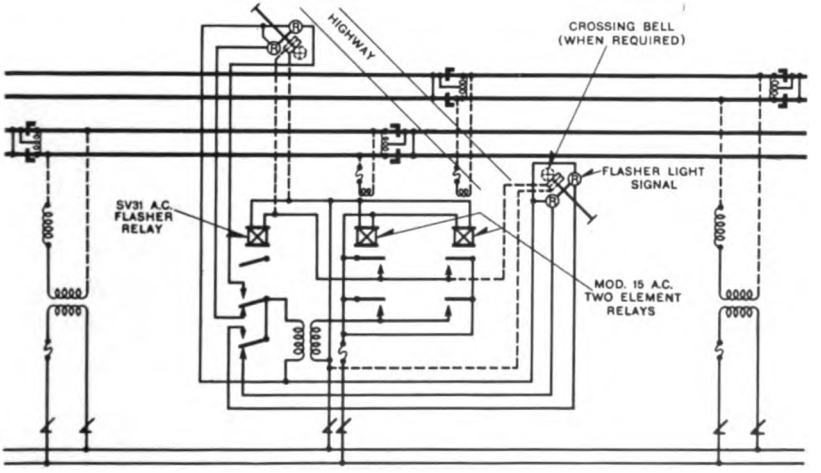

Fig. 8

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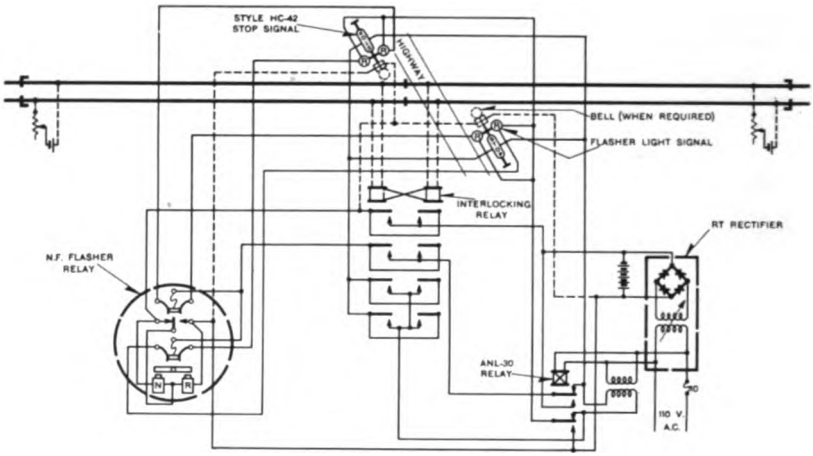

Fig. 9

Circuit Diagram, Fig. 9, illustrates a simple automatic scheme for highway crossing protection on a single track road as described in Figs. 1 and 3, and in addition shows the application of the "Union" Style HC-42 "STOP" Sign which is described on page 14. This circuit may readily be altered to provide a flashing, instead of a steady "STOP" indication as shown.

Circuit Diagram, Fig. 10, illustrates an automatic scheme for highway crossing protection on a single track road having d-c. track circuits and two crossings spaced approximately a city block length apart. The elements entering

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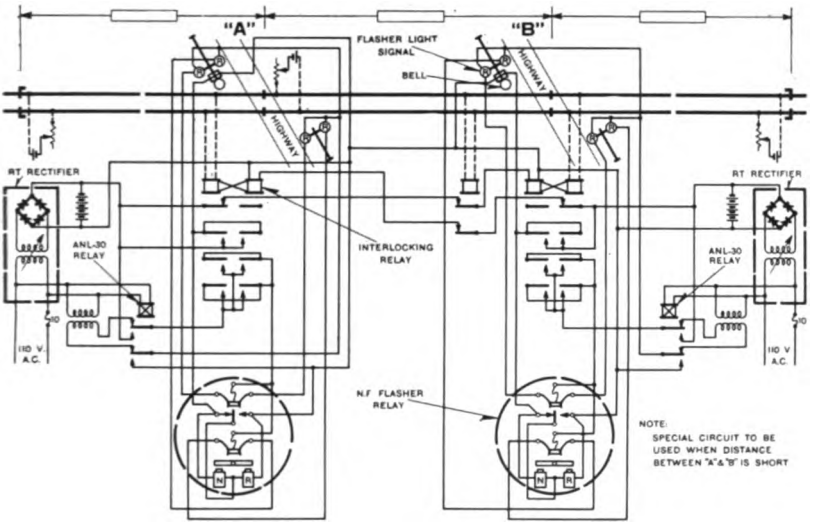

Fig. 10

into this installation differ only in slight detail from others previously described.

With this arrangement the signals at "A" and "B" start flashing simultaneously at the approach of a train from either direction, but cut out progressively as the rear end of trains pass respective crossings. The circuits and elements may vary for shorter or greater distances between crossings, which in this instance may be assumed to be between 200 and 400 feet. The period of approach, based upon the maximum train speed allowed, determines to a large extent the apparatus used and its arrangement (see curve page 35).

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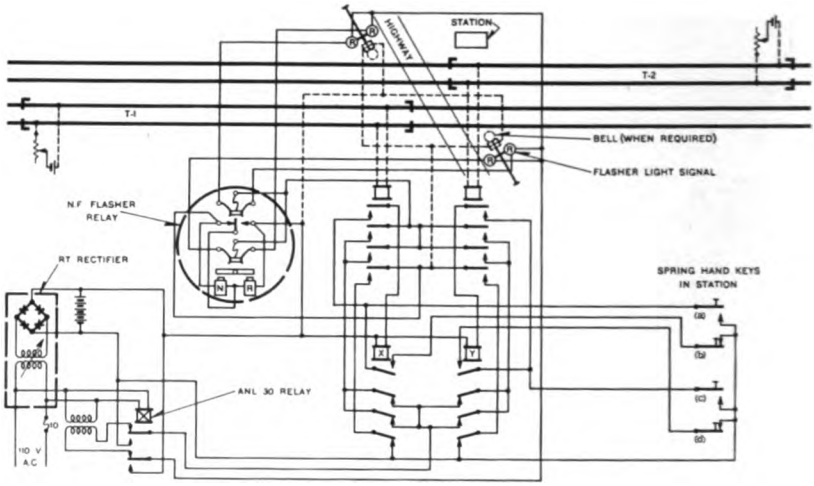

Fig. 11

Circuit Diagram, Fig. 11, illustrates a scheme for highway crossing protection on a double track road using d-c. track circuits and providing for semi-automatic control from a station or tower. This arrangement is desirable where trains may stand at stations for long periods. Modifications may be made to suit peculiar conditions applying at varying locations.

When a train is standing on track circuit T-1, the station attendant, to stop the warning signal, momentarily closes key (a) to pick up line relay X, which then remains energized through a "stick circuit" closed normally by key (b). When,

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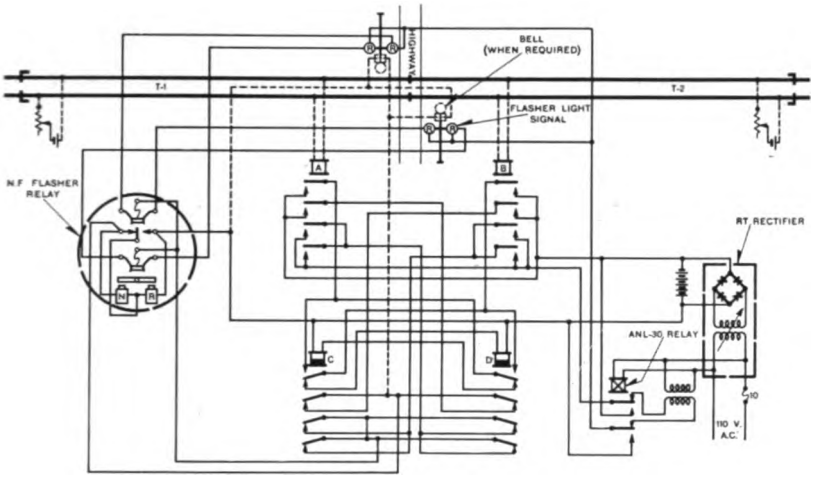

Fig. 12

however, key (b) is momentarily depressed, the "stick circuit" is opened and the action of the warning signal is resumed. Likewise, relay Y and key circuit controllers (c) and (d) function to annul and continue the action when a train is on track circuit T-2.

Some railroads use stick relays in combination with track relays to produce the same result as is obtained with interlocking relays. The circuit shown in Circuit Diagram, Fig. 12, is typical of what is used on one railroad at simple highway crossings.

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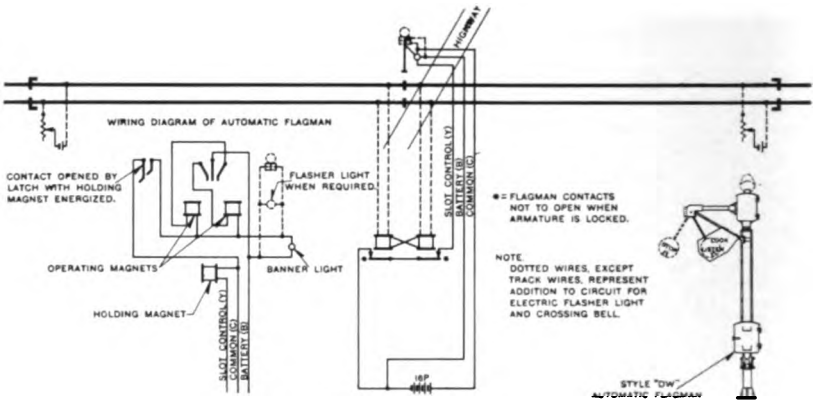

Fig. 13

Circuit Diagram, Fig. 13, illustrates an application of the "Union" Style DW Automatic Flagman (described on page 15) at a highway crossing on a single track railroad. The interlocking relay has "flagman contacts" (described on page 37) which assure a closed slot circuit when the rear of the train passes the crossing, thus stopping the signal's action. Power supply schemes similar to those shown in other circuit diagrams may be used and double or multiple track crossing protection using one or two Automatic Flagmen may readily be provided.

The length of the approach track circuits and the maximum allowable train speed determine the warning period

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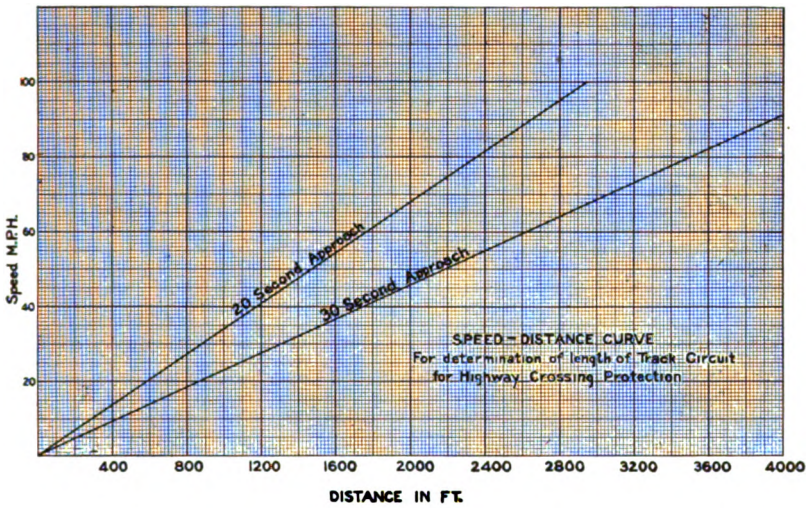

Fig. 14

provided before the front of the train crosses the highway. The American Railway Association has recommended limits of 20 to 30 second periods as satisfactory in most cases. Assuming the period to be 30 sec., and the maximum allowable speed to be 60 mph., the length of track (2,600 ft.) to be track circuited will be found in the horizontal scale of curve Fig. 14 above, directly below the intersection of the 30 sec. curve with the 60 mph. line.

The two approach track sections to a highway crossing may vary in length, depending upon traffic operating conditions applying for movements made towards the crossing from either side.

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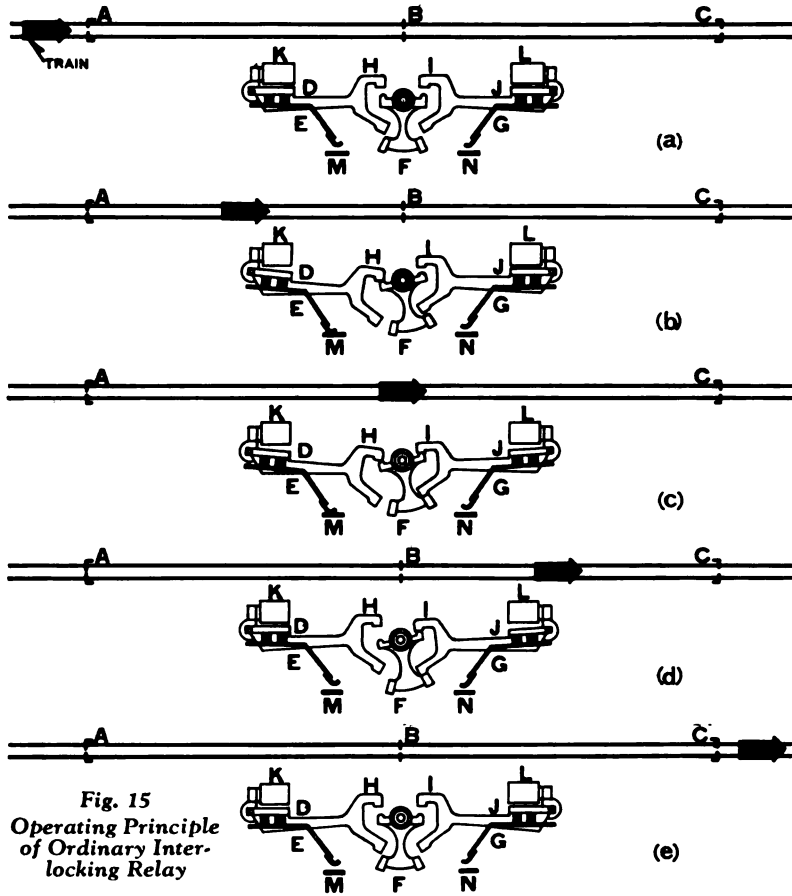

Fig. 15
Operating Principle of Ordinary Interlocking Relay

The functioning of the "Union" Interlocking Relay is explained in the five diagrams shown above, wherein a train is shown moving progressively through the track circuits. Upon release of *D* Fig. 15 (b), arm *H* pushes locking pawl *F* over in the path of engagement with arm *I*. When *L* becomes de-energized, arm *I* falls and locks up on pawl *F* as shown in Fig. 15 (c). Contact NG does not close and a means is thus provided so that crossing signal action ceases when the last car of a train passes the crossing. The sym-

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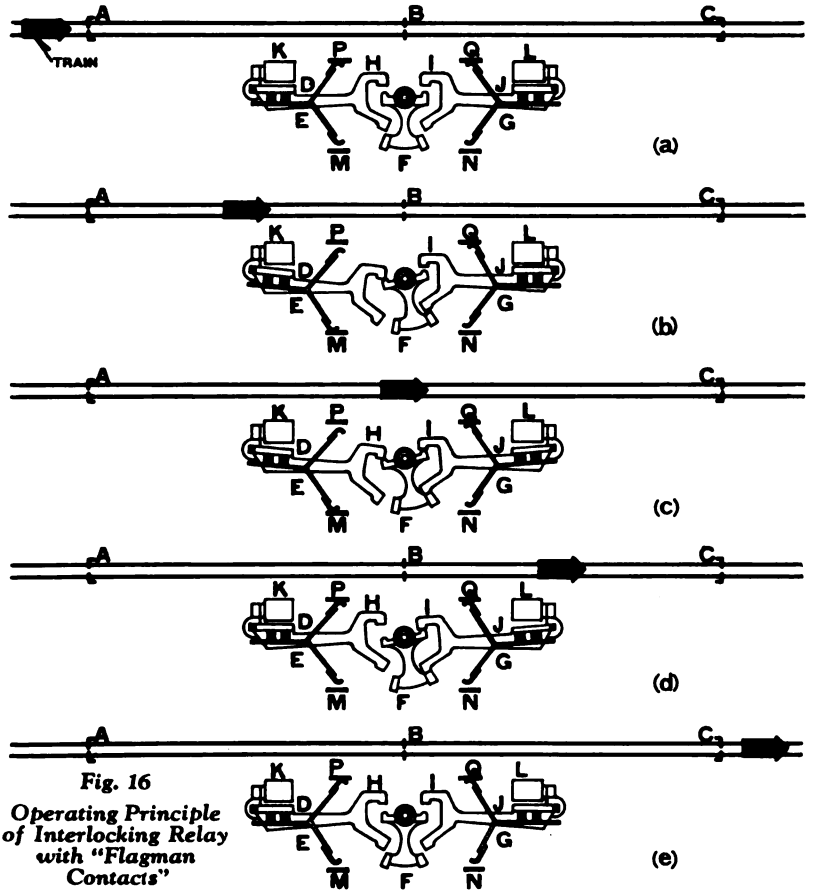

Fig. 16
Operating Principle of Interlocking Relay with "Flagman Contacts"

metrical arrangement of the circuit and locking device causes equivalent action upon a reverse move being made.

The term "Flagman Contact" is used in the explanatory notes in some circuit diagrams. A Flagman Contact is a front contact such as QJ Fig. 16 (c) which does not break the circuit when its locking arm *I* engages with locking pawl *F* after it has been moved over by *H* into the path of engagement with *I*. A Flagman contact such as PD Fig. 16 (b) is opened, when its armature is the first of the two to drop away.

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Information Which Should Accompany an Inquiry

We shall be glad to supply engineering information and quote on material for Highway Crossing Installations. Inquiry should be accompanied with a scale track plan showing the location of the highway and any switches or present signaling which comes within the approach section. The following points should be covered:

Specify

1—What special operating conditions exist within the area.

2—Whether steam or electric propulsion railway.

3—What electric power is available for operation of signals.

4—If A.C., the voltage and frequency and advise whether stand-by service is required (Can continuity of service be depended upon).

5—Type of Crossing Signal.

(a) Flashing Light, (b) DW Automatic Flagman; If (a), are illuminated "STOP" attachment and side lights wanted?

6—Length of approach section each side of crossing. (See curve on page 35).

7—If double track road, shall protection be provided for reverse traffic.

8—Weight and type of rail and whether four or six hole insulated rail joints.

9—Whether rock, gravel, sand or other material track ballast.

10—Whether location of signals is to be at side or center of street or road. If latter, are Pilot Lights wanted?

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11—Whether paved, planked or dirt highway and if paved, advise as to class of paving.

12—Whether the signal is desired with or without cross-buck sign; also, with or without bell or bells, if with, will one or two be required.

If for Electric Propulsion Road

13—Advise as to propulsion voltage and whether d-c. or a-c. If a-c., give frequency.

14—What is normal and maximum return current in rails.

For complete ordering references for the various combinations and details of the Style HC-5 Highway Crossing Signal and Style HC-42 Stop Sign, see Catalog Section K—Plates K-120 to K-137.

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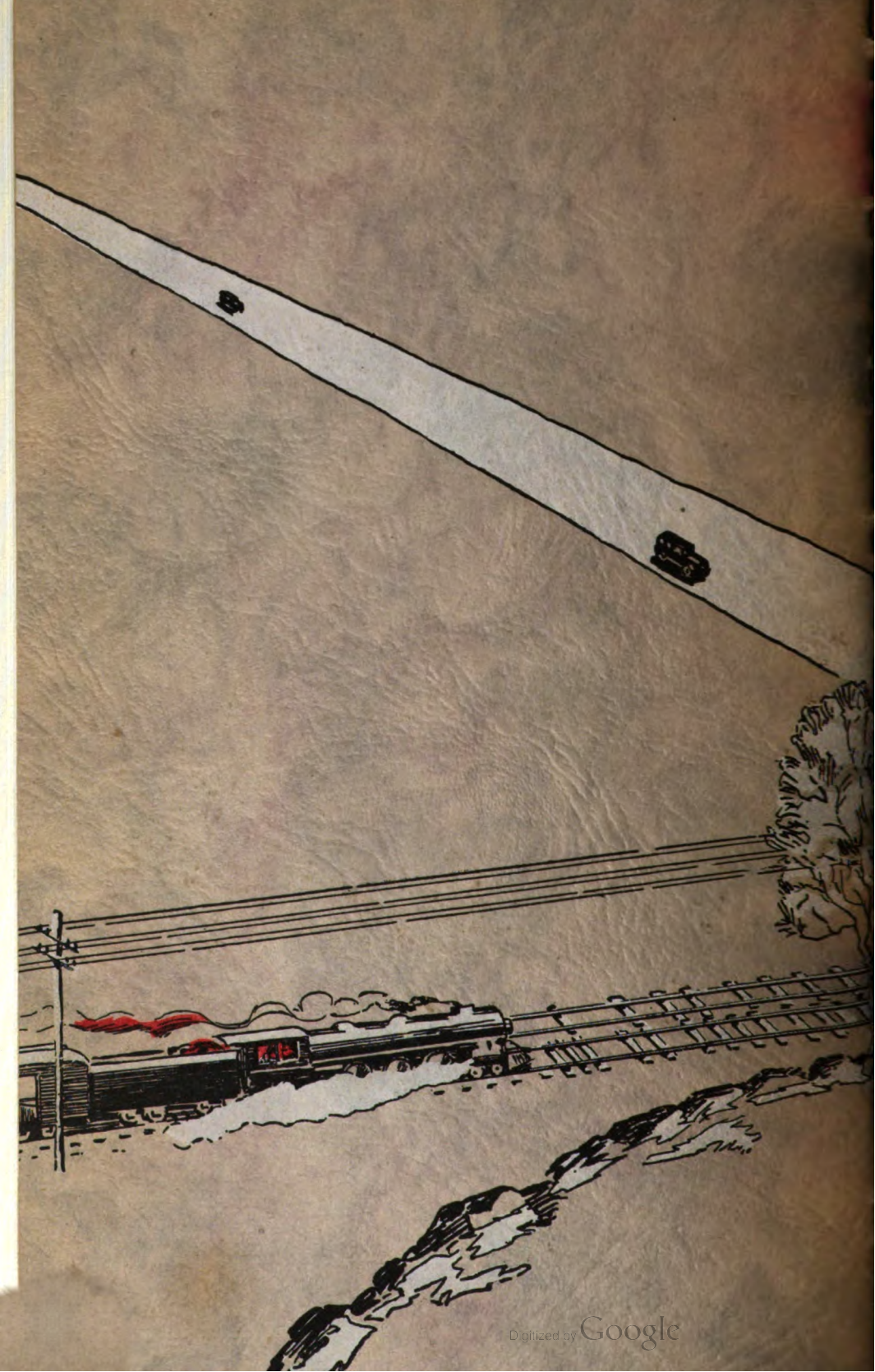

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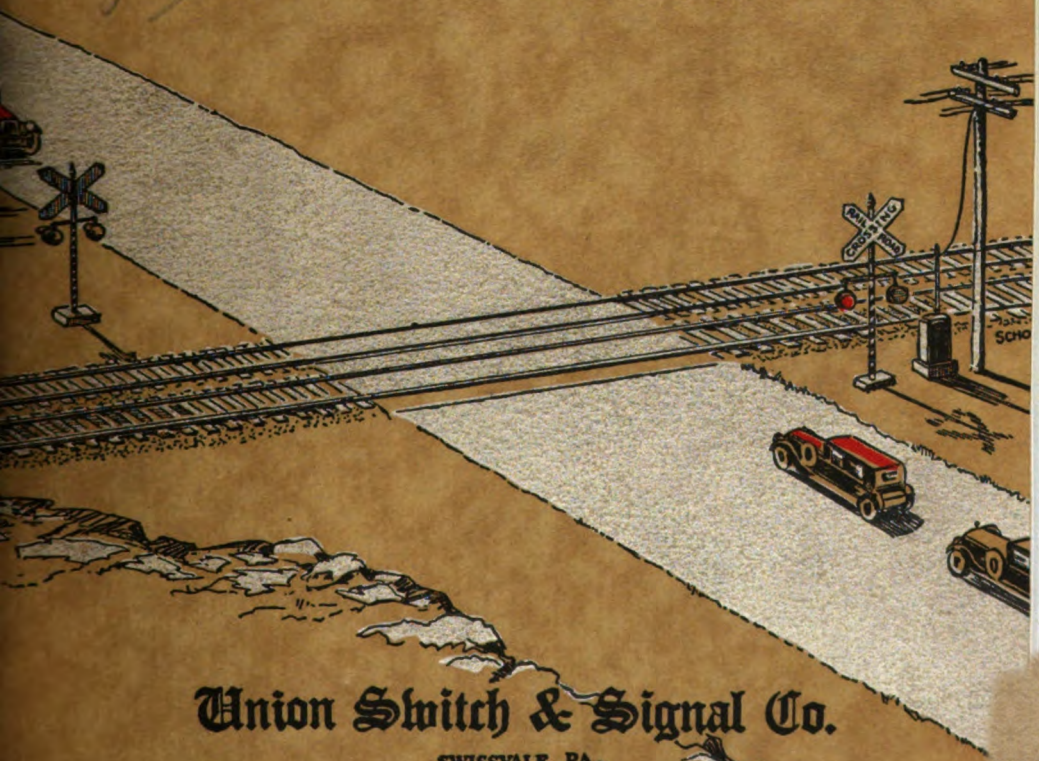
PROTECCIÓN
en los Pasos a Nivel

Boletín No. 125-S



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Proteccion
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BOLETIN 125-S
OCTUBRE, 1929

Union Switch & Signal Company
SWISSVALE, PENNSYLVANIA
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Proteccion
en los
Pasos a Nivel

BOLETÍN 125-S
OCTUBRE, 1929

Union Switch & Signal Company
SWISSVALE, PENNSYLVANIA
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ADVERTENCIA

La aplicación generalizada de la protección en los pasos a nivel, exigida por las condiciones actuales, ha dado por resultado la creación de aparatos nuevos y perfeccionados para cada caso particular. Desde que se empleó el primer circuito de vía, la Union Switch & Signal Company se ha esforzado por idear instalaciones completas que han venido progresivamente ofreciendo el mayor grado de protección posible, cada vez que se ha hecho necesario perfeccionar los aparatos a fin de hacer frente a las crecientes exigencias del tráfico.

Aunque este boletín se refiere más que todo a la nueva Señal "Union" de luz intermitente de color Estilo HC-5, contiene también la descripción de otros aparatos y accesorios. Su objeto es el de suministrar, además, ciertos datos generales que pueden resultar interesantes y útiles.

Las ilustraciones representan instalaciones de aparatos empleados en los Estados Unidos, las cuales por lo tanto llevan los letreros e inscripciones en inglés. Los aparatos destinados a otros países se suministran con los letreros en el idioma que conviene y de acuerdo con las costumbres establecidas en el lugar en que han de utilizarse.

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Señales de luz intermitente Estilo HC-5 en un paso a nivel—F. C. Pere Marquette.

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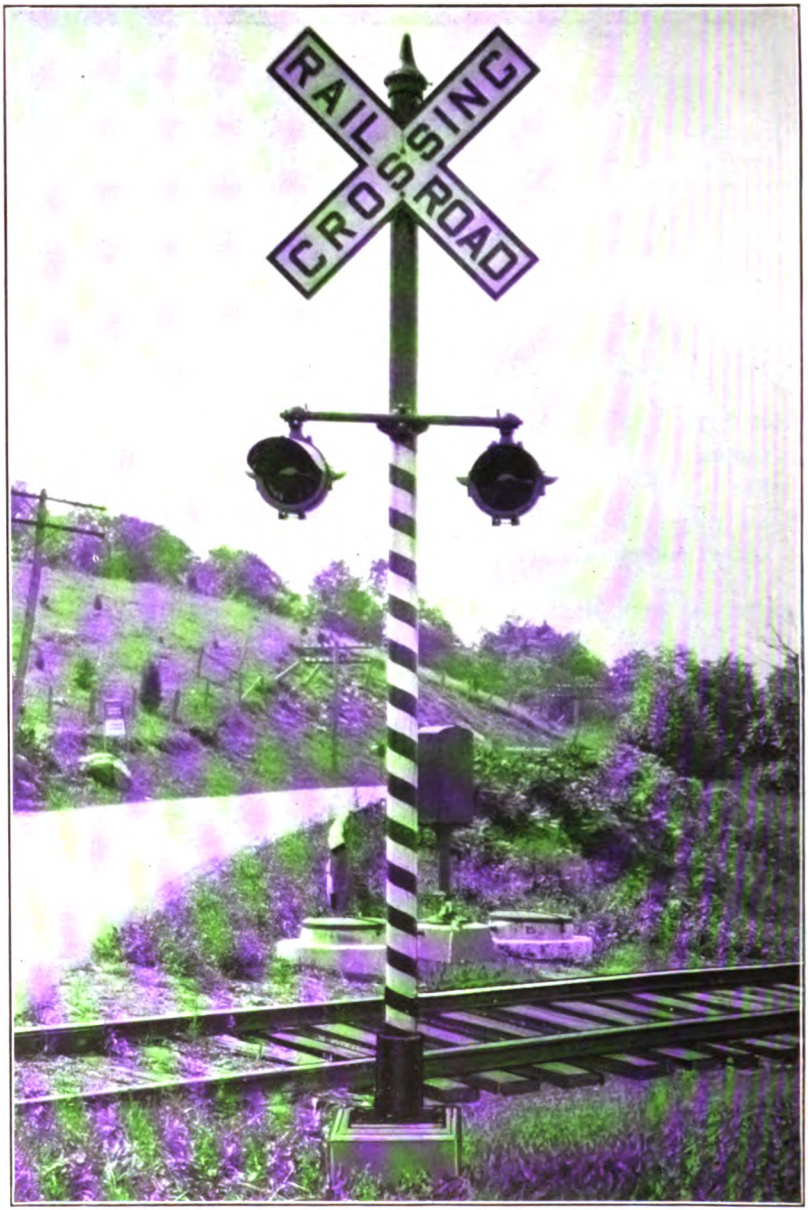

Señal Estilo HC-5 en un ramal del F. C. del Erie

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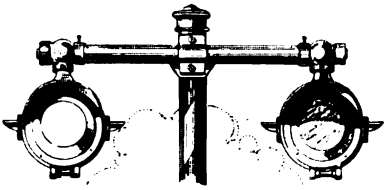

Protección en los pasos a nivel

EN VISTA de que los cruces de carretera con una línea férrea, o sean los pasos a nivel, no podrán ser suprimidos antes de que pasen muchos años, las empresas ferroviarias y las autoridades del gobierno y de las municipalidades tienen por fuerza que valerse de los medios actualmente disponibles para evitar los peligros en esos cruces. Los pasos a nivel con aparatos de protección a mano y empleados guardavías resultan sumamente costosos de mantener, fuera de que están sujetos a las flaquezas del elemento humano. La tendencia actual es por lo tanto la de valerse de señales automáticas ya sean con luces intermitentes de colores o del tipo de guardavía.

Ese riguroso servicio exige refinamientos de trazado y de fabricación que sólo una organización importante y experimentada puede realizar de manera adecuada. Si bien la claridad absoluta de una señal para caminos, en cuanto a sus indicaciones y a su aspecto, es factor de considerable importancia, la construcción del aparato y el principio que rige el funcionamiento de sus diversos elementos, así como la seguridad de una alimentación de corriente infalible, son igualmente o acaso más importantes aún.

La Union Switch & Signal Company fabrica aparatos de señales para ferrocarriles desde hace medio siglo y la nota dominante del trazado de todos sus productos ha sido siempre la de "Seguridad y Funcionamiento Infalible." Los aparatos Union son no sólo los más perfectos en sí, sino que forman, en conjunto, la combinación de elementos más satisfactorios que pueden integrar una instalación completa.

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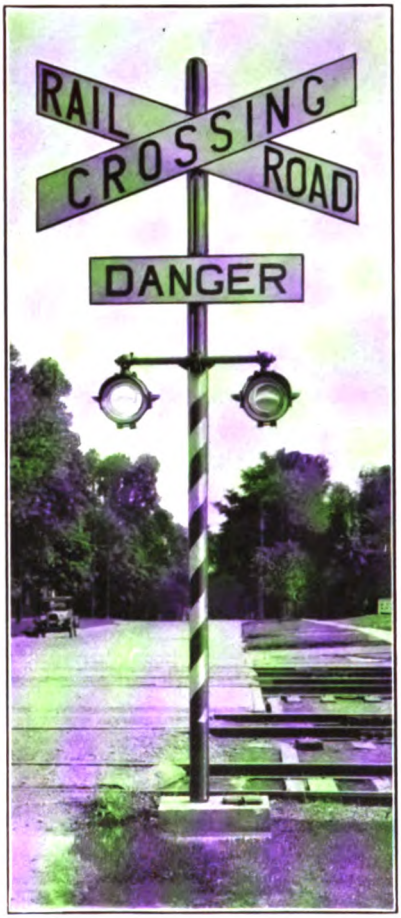

Izquierda—
Señal Estilo HC-5 en el F. C. de Pensilvania.

Derecha—Señal HC-5 con letrero de "Alto" HC-42 en el F. C. de Wabash.

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Tipo de señal

Este folleto describe y presenta varios tipos de aparatos protectores "Union" para pasos a nivel. A fin de evitar toda confusión en la mente del lector, cabe decir aquí que, si bien puede a veces escogerse entre diversos modelos "Union" que satisfacen los mismos fines, la elección de los elementos de la instalación se efectúa generalmente de acuerdo con un procedimiento lógico basado en las prácticas adoptadas por la empresa ferroviaria y en la clase de corriente eléctrica de que se dispone.

En la página **40**, se hallará un cuestionario por medio del cual se puede determinar más fácilmente el tipo especial de material que debe adoptarse. En la página **37**, hay un gráfico por medio del cual se puede calcular la longitud del circuito de vía de acceso. En las páginas **26** a **36** figuran la reproducción y la explicación de los esquemas de conexiones relativos a varias combinaciones usuales de aparatos. Además, se da una descripción detallada de las señales de cruce y de los aparatos auxiliares, así como los datos necesarios para la formulación de pedidos.

Las señales de cruce "Union" se dividen en dos tipos generales, a saber: (1) El guardavía automático Estilo DW (de tres aspectos) con brazo de señal oscilante y luz, con timbre o sin él; (2) las señales de luz intermitente, de varios modelos, con timbre o sin él. Este boletín tiene por objeto principal describir la señal "Union" Estilo HC-5 de luz intermitente, aparato recientemente creado, que ha sido objeto de una aceptación inmediata y se emplea ahora con éxito en todas partes.

Señal Estilo HC-5 de Luz Intermitente

El alcance excepcional y la gran difusión de la luz indicadora constituyen las características sobresalientes de la señal HC-5. Gracias a ello, el Estilo HC-5 puede emplearse de manera general no sólo para todas las instalaciones de protección en las inmedia-

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ciones de los cruces de carretera con vía férrea, sino también para satisfacer los requisitos de diversos ferrocarriles en que rigen diferentes limitaciones permisibles. Puede por lo tanto decirse que la señal "Union" Estilo HC-5 es de "aplicación universal."

Cruce resguardado por señales de luz intermitente Estilo HC-5—F. C. de Pensilvania.

Conjunto

El conjunto de la señal Estilo HC-5 consta generalmente de dos faroles suspendidos de un brazo tubular transversal fijado en un poste tubular. La distancia normal entre los faroles es de 76 cm. Los faroles van atornillados en una conexión en T dispuesta en cada extremo del tubo transversal, lo que asegura un buen alineamiento horizontal y vertical, y se fijan por medio de tornillos de presión. El tapón tubular de los extremos de las

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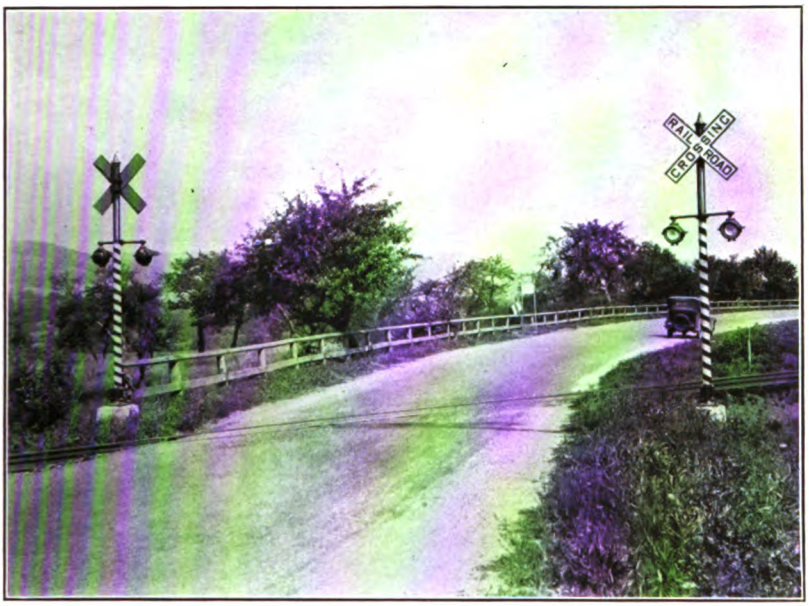
conexiones en T pueden sacarse para facilitar la colocación de los alambres conductores de los faroles. Entre el farol y la conexión en T, hay una unión intermedia empernada que permite armarlo sin retorcer los alambres. Esta señal puede emplearse



Cruce resguardado por señales de luz intermitente Estilo HC-5—F. C. del Erie

combinada con un letrero transversal, un letrero de "ALTO" iluminado, un timbre de cruce y una caja de instrumentos, según lo requiera la naturaleza de la instalación.

Farol

La característica principal de la señal HC-5 es su sistema óptico. Gracias al excelente y duradero reflector colocado detrás de la

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bombilla, se utiliza una proporción muy grande de la fuerza lumínica de la lámpara.

El lente es de tipo nuevo en el sentido de que da una difusión

Señal Estilo HC-5 con luces indicadoras para instalación en el centro de una calle. A la izquierda, arriba—el farol abierto. A la izquierda, abajo—luz indicadora

de luz perfectamente visible en un radio de 160 grados. La forma semicónica del vidrio permite colocar aros prismáticos en la

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superficie interna de los lados rectos, que recogen la luz de la bombilla y la difractan de tal modo que la señal resulta bien visible lo mismo en frente que a un lado del aparato. La forma de la parte connexa delantera del lente determina la del hazluminoso principal. Este lente está hecho de manera que proyecta, por su eje óptico, un fuerte haz de luz de ángulo muy abierto en el plano horizontal. En todos los puntos situados por debajo de la horizontal, el lente emite también una luz de igual divergencia por toda su superficie.

Los rayos de luz que atraviesan la parte convexa principal del lente se esparcen y se sobreponen a la luz salida de los lados del farol, de modo que la señal luminosa resulta uniforme cuando se pasa de un punto de observación a otro. Todas las secciones prismáticas de la superficie interior son lisas por fuera, de modo que se limpian fácilmente.

Estos faroles llevan lentes de vidrio rojo especial de alta transmisión, de acuerdo con los requisitos de la American Railway Association (Asociación de Ferrocarriles Americanos) para señales de paso a nivel.

La base de la bombilla es del tipo de bayoneta S-11 de un solo contacto y puede suministrarse para casi todos los voltajes y para fuerza lumínica hasta de 25 vatios, aproximadamente. La bombilla que se recomienda es del tipo de 11 voltios, 11 vatios.

El receptáculo de bombilla está montado en un soporte de metal fundido, aislado del farol hasta para una corriente de 3000 voltios. Los bornes para la conexión de los alambres son del tipo normal recomendado por la American Railway Association. Los receptáculos de bombilla se colocan con exactitud en nuestra fábrica, asegurándose firmemente el portalámpara. Cuando se emplean, para reemplazar las lámparas rotas o quemadas, bombillas cuya precisión no varía en más de 1/64″ (0,4 mm.), no hace falta volver a efectuar ajuste alguno.

Portalente y caperuza

El portalente consiste en una caja de hierro fundido formada por dos piezas engoznadas, de modo que puede abrirse para fa-

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cilitar las conexiones y la renovación de la bombilla. El portalente tiene un cerrojo que permite cerrarlo si se desea. El farol tiene también lentes laterales, pero éstos pueden fácilmente taparse si no se desean.

La caperuza que protege el lente contra los rayos directos del sol es ajustable. Una serie de agujeros permite darle vuelta y fijarla de manera que no oculte la señal a los ojos de los que pasan por la carretera. Tanto el farol como la caperuza están revestidos de esmalte negro recocido al horno y muy duradero.

Luces indicadoras

Para la instalación en el centro de las calles, se suministra un conjunto de luces indicadoras y caja de bornes muy eficaz, tal como se ve en el grabado de la página 12. Las luces rojas fijas sirven de advertencia a los conductores de los vehículos que recorren la carretera, mas las lámparas tienen pantallas que evitan la posibilidad de que se vean desde la vía férrea.

Protegiendo un camino de mucho tráfico con señales de luces.

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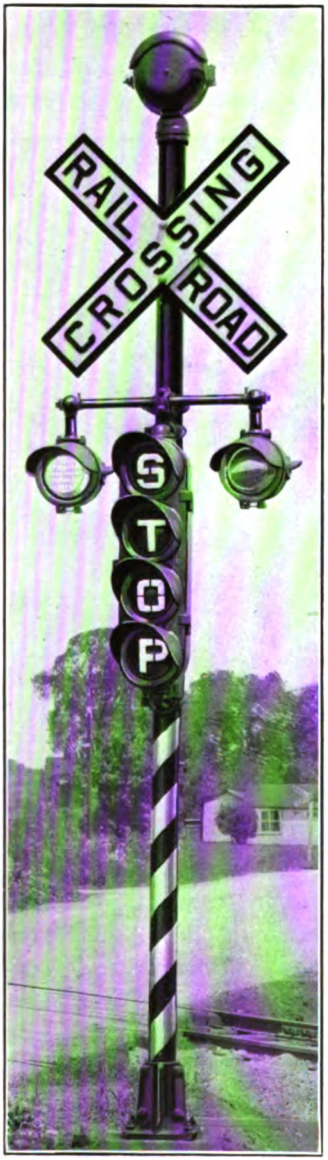

Letrero de "Alto"

El letrero de "ALTO" iluminado que figura en esta página se emplea de manera muy general con la señal Estilo HC-5, mas puede igualmente adaptarse a señales de otros estilos. El letrero de "ALTO" consta de cuatro (4) faroles superpuestos en una misma caja de hierro fundido.

Cada farol encierra una bombilla de 11 voltios, 11 vatios, con desviación máxima de precisión de 1/64", cuyo enchufe o portalámpara queda exactamente centrado en un reflector de vidrio. Entre el lente y la bombilla de cada farol hay una pieza opaca con una abertura que afecta la forma de una de las letras de la palabra "ALTO". Todos los faroles permanecen normalmente apagados, mas cuando se acerca un tren en la vía, las bombilles se encienden y aparece claramente un letrero que dice "ALTO" en letras de un rojo vivo y llamativo. Esta señal, conocida con el nombre de letrero de "ALTO" iluminado, Estilo HC-42, se halla descrita con todos sus detalles en la lámina K-130 de nuestro catálogo.

Señal HC-5 con letrero de "Alto" HC-42 en el F. C. Union de Indianápolis

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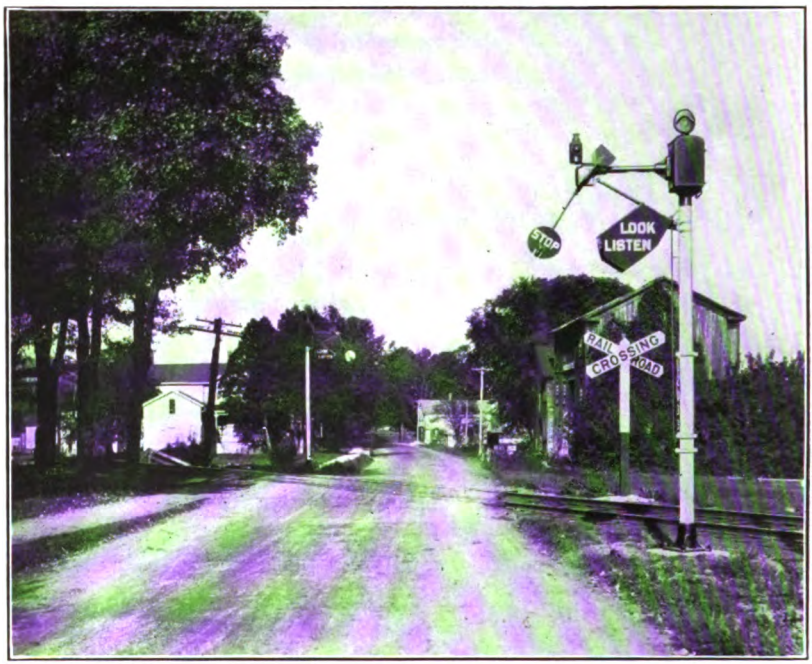
Guardavía automático Estilo DW

El Guardavía Automático Union Estilo DW da una señal que se impone a los conductores de vehículos. El mecanismo de este



Guardavías automáticos Estilo "DW" en el F. C. Delaware, Lackawanna & Western

aparato es del tipo magnético, de sólida construcción, y da tres distintas señales, a saber: "Alto" (el brazo oscila), "Pase" (el brazo permanece oculto) y "Descompuesto" (el brazo pende verticalmente, sin moverse). Este guardavía se suministra para funcionar con corriente continua o con corriente alterna, y puede ser fácilmente provisto de timbres de cruce, letreros u otros accesorios requeridos. Su descripción se halla en el Boletín No. 86 y los detalles completos y referencias figuran en las láminas K-1 a K-51 de nuestro catálogo de 1924.

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Material auxiliar

Como el circuito de la vía es el que alimenta y rige las señales de cruce, es indispensable disponer de aparatos llamados "relais"

Compartimiento delantero de la caja de instrumentos, en que se ven el relai de luz intermitente Estilo "NF" y el relai de cierre

o relevadores entre ese circuito y la señal. El número y tipo de esos relais dependen de las condiciones y reglamentos establecidos. En las páginas que siguen, se hallarán la descripción sucinta y las ilustraciones de los dispositivos de gobierno más importantes que generalmente se emplean. Se indican también las láminas de nuestro catálogo en que pueden encontrarse, a fin de que puedan formularse los pedidos con todo conocimiento de los detalles.

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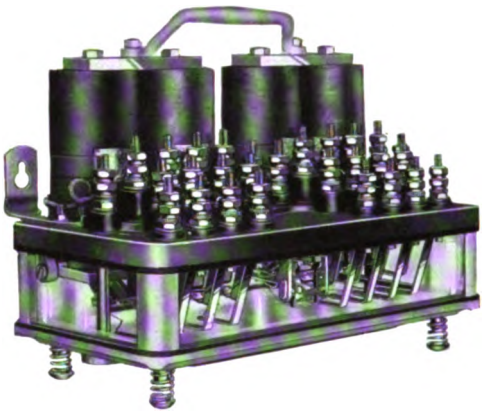
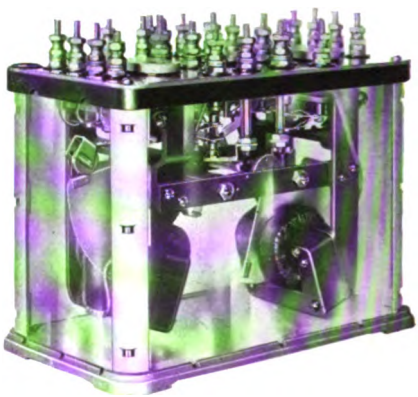
Relais de cierre

Los relais de cierre de los tipos que aquí se ven sirven para hacer funcionar las señales de aviso cuando se acerca un tren desde uno u otro lado en los ferrocarriles de una sola vía y, como



Relai de cierre Estilo DX-13 Dimensiones: 16,5 x 31,7 x 21,6 cm. de altura (inclusive los resortes)

Relai de cierre Modelo 16 para corriente alterna. Véase la lámina E-1100 del catálogo. Dimensiones: 29,8 x 16,5 x 27,4 cm. de altura



sucede a menudo, en los de dos o más vías. Estos relais hacen cesar la señal después de que el tren ha pasado el cruce. (Véanse los esquemas Figs. 15 y 16).

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Relai neutro Modelo 13. Véase la lámina E-4810 del catálogo. Dimensiones: 17,8 cm. de diámetro y 22,5 cm. de altura

Relai neutro Estilo DN-11. Véase la lámina E-4900 del catálogo. Dimensiones: 15,9 cm. cuadrados y 20,3 cm. de altura

Relai de aleta Estilo SLV-13. Véase la lámina E-1005 del catálogo. Dimensiones: 20,3 cm. de diámetro y 25,4 cm. de altura

Relai de aleta Modelo 15. Véase la lámina E-1020 del catálogo. Dimensiones: 22,9 cm. de anchura, 25,4 cm. de fondo y 26,7 cm. de altura

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Relais de vía y de línea

Los relais de vía que aquí figuran se emplean cuando los trenes no pasan sino en un solo sentido. Estos relais tienen también muchas aplicaciones para el servicio de señales ferroviarias.

Relais de luz intermitente

Debido a su robusta construcción, a su sencillez de funcionamiento y a su seguridad, el relai Union Estilo NF se recomienda altamente para regir las señales de luz intermitente y alterna de todos los tipos. Salvo que se pida de otro modo, este relai se

Relai de luz intermitente Estilo "NF" para corriente continua. Véase la lámina E-5050 del catálogo Dimensiones: 17,8 cm. de diámetro y 25,7 cm. de altura

entrega graduado de modo que produzca períodos de luz uniformes a razón de 30 a 35 veces por minuto.

En los esquemas de circuito Figs. 1, 2, etc., para mayor sencillez, las cuatro bobinas del relai NF estan representadas por una bobina para cada par. Los dos pares de bobinas están conectados permanentemente en serie, y hay, entre ellos, un contacto regido por la armadura y dispuesto de tal modo que pone cada par en derivación, alternativamente, de acuerdo con la posición de la armadura. Cuando este relai no recibe corriente, el contacto se

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halla normalmente sesgado, con un par de bobinas en derivación, de modo que puede luego entrar en juego sin tardanza. La armadura del relai lleva otros dos juegos de contactos por medio de los cuales llega la corriente a las lámparas de señal. Estos no se separan sino en las posiciones extremas respectivas de la armadura. Gracias a esta disposición, se tiene la seguridad de que por lo menos una de las lámparas de cada una de las señales de cruce tiene que encenderse.

Relai de luz intermitente Estilo SV-31 para corriente alterna. Véase la lámina E-1062 del catálogo. Dimensiones: 25,4 cm. de anchura, 22,9 cm. de fondo y 26,7 cm. de altura

El relai de luz intermitente Estilo SV-31 del tipo de aleta se emplea para los circuitos de corriente alterna. El circuito de gobierno para el relai se interrumpe a períodos uniformes por medio de un mecanismo muy sencillo encerrado en el propio relai.

Relai de transferencia de corriente

Como la seguridad del funcionamiento es requisito indispensable de toda instalación de protección para los pasos a nivel, hemos creado el relai de transferencia de corriente Union ANL-

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30 por medio del cual pueden transferirse los circuitos de gobierno de la corriente alterna susceptible de interrupciones, a una fuente

Relai de Transferencia Estilo "ANL-30". Véase la lámina E-1175 del catálogo. Dimensiones: 16,5 x 9,2 x 9,2 cm.

de energía de reserva generalmente constituída por una batería de pilas primarias o una batería de acumuladores de carga lenta.

Rectificadores para cargar baterías

A fin de que pueda disponerse de una fuente de energía siempre lista y económica cuando no se puede confiar enteramente en el suministro de corriente alterna, ofrecemos una serie completa de rectificadores "Union" para la carga de baterías de acumuladores.

Rectificador Estilo RT-10 Lámina S-4 del catálogo Dimensiones: 16,5 x 17,1 x 15,2 cm. de altura

Rectificador Estilo RX-10 Lámina S-20 del catálogo Dimensiones: 16,5 x 17,1 x 12,7 cm. de altura

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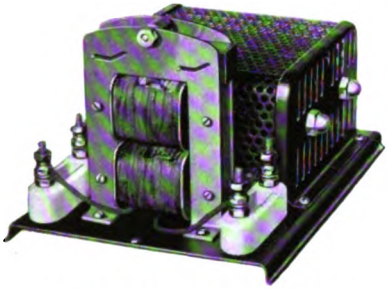
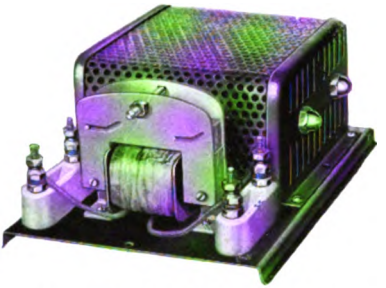


Rectificador Estilo RT-21
Lámina S-10 del catálogo
Dimensiones: 21, 6 x 29,8 x 17,8 cm. de altura



Rectificador Estilo RX-21
Lámina S-25 del catálogo
Dimensiones: 21,6 x 29,2 x 12,7 cm. de altura

Estos rectificadores, cuatro de los cuales figuran en estas páginas, se hallan descritos de manera detallada en el Boletín No. 111 y en la sección S de nuestro catálogo. Las figuras 1 a 12 muestran algunas de sus aplicaciones usuales. Los rectificadores de los estilos RT-10 o RX-10 mantienen también las baterías de acumuladores de la vía enteramente cargadas.

Transformador Estilo "W"
Dimensiones 12 x 19,7 x 22,9 cm.

Transformador

El transformador Union Estilo "W" se recomienda para toda clase de instalaciones de señales ferroviarias y de protección en los pasos a nivel. El voltaje del primario puede ser hasta de 575 voltios, con las frecuencias comerciales, pudiéndose utilizar un máximo de 24 bornes del tipo A. R. A. Puede suministrarse con arrollamientos secundarios múltiples.

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Timbre de cruce
Modelo 15-A

Timbre de cruce

Los timbres Modelo 15-A para pasos a nivel, del tipo que aquí se ve, constituyen desde hace muchos años uno de los productos más conocidos de la marca "Union" y se ofrecen para funcionar con corriente continua o con corriente alterna. Los datos completos acerca de los timbres Modelo 15-A se encuentran en las láminas K-75 a K-90 del catálogo.

Otros aparatos accesorios para la protección en los pasos a nivel son los siguientes:

Reostatos, bobinas de reacción y conectadores de impedancia. Sección F del catálogo

Pararrayos ..... Sección P del catálogo

Circuitos

No nos es posible presentar más que algunos de los circuitos más generalizados para el gobierno de las señales de paso a nivel.

Los circuitos que figuran en las páginas siguientes presentan las características básicas requeridas, pudiéndose ampliarlas o modificarlas según lo exijan las circunstancias. Aunque se indican baterías primarias para la alimentación de los circuitos de vía de corriente continua, pueden emplearse acumuladores de

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carga lenta con rectificadores (véase las páginas 22 y 23), cuando se dispone de corriente alterna adecuada.

Compartimiento posterior de la caja del mecanismo en que se hallan el relai de cierre, el relai de transferencia ANL-30, el rectificador RX-21, etc.

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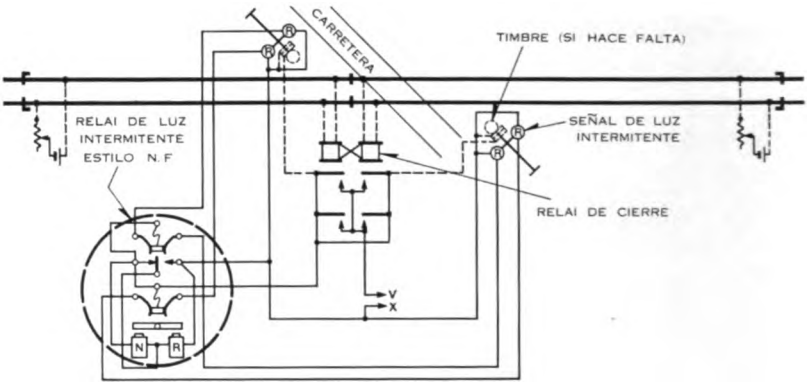


Fig. 1. Circuitos para el gobierno de las señales de cruce del tipo de luz intermitente en los ferrocarriles de una sola vía con circuito de vía de corriente continua

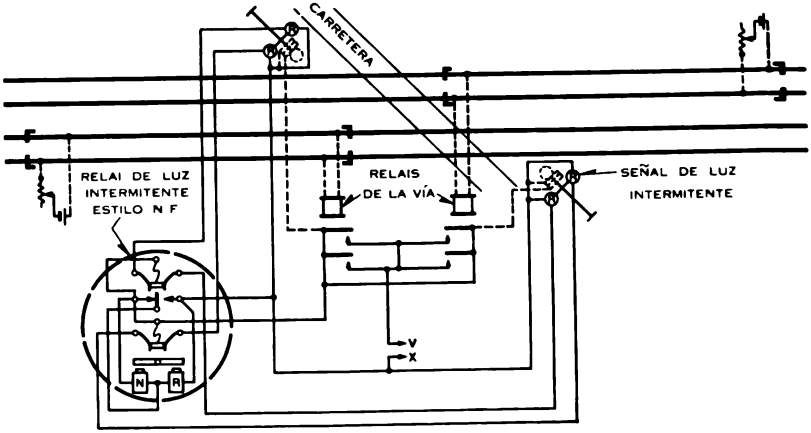
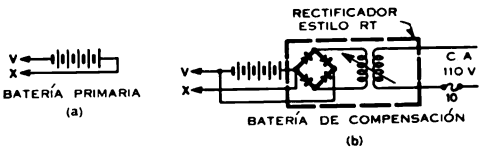


Fig. 2. Circuitos para el gobierno de las señales de cruce del tipo de luz intermitente en los ferrocarriles de doble vía con circuito de vía de corriente continua



Baterías que pueden emplearse con los circuitos Figs. 1 y 2

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Los circuitos para cruces de línea de una sola vía aseguran la protección en ambas direcciones de marcha de los trenes. Cuando los trenes suelen recorrer una vía doble en ambos sentidos, pueden adoptarse, con los esquemas de circuito de dos vías, las partes de los esquemas de una sola vía que muestran el circuito de vía y los relais de cierre.

Los timbres son de uso facultativo y sus circuitos están señalados con líneas de puntos. El número de timbres para cada cruce depende de las condiciones locales, pero generalmente no hace falta más que uno.

Junto con cada circuito, o en la página opuesta, hay una breve descripción del esquema de conexiones. Los esquemas llevan también marcados los aparatos esenciales que se requieren para cada instalación completa.

Los circuitos que se presentan son los más usuales y, para mayor sencillez, se han omitido en ellos los contactos múltiples. Los relais tienen generalmente cuatro dedos de contacto o más y, cuando se dispone de contactos suplementarios, pueden conectarse en múltiple para distribuir la corriente y reducir la resistencia en los contactos.

Los esquemas de circuito Figuras 1 y 2 representan instalaciones automáticas sencillas para la protección de los cruces o pasos a nivel en los ferrocarriles de vía sencilla o doble con circuitos de vía de corriente continua.

Para la operación del relai de luz intermitente NF y las lámparas de señal, pueden emplearse baterías de pilas primarias o baterías de acumuladores. El esquema (a) presenta una simple batería primaria cuyos conductores están marcados "V" y "X" y corresponden con las mismas letras en las Figs. 1 y 2. El esquema (b) muestra una batería de acumuladores de carga lenta que se emplea generalmente cuando se dispone de una línea de fuerza de corriente alterna. El rectificador Estilo RT-10 que se emplea en este caso figura en la página 22.

Los esquemas de circuito Figs. 3 y 4 son para los mismos casos que los de las Figs. 1 y 2, sin embargo presentan ciertos perfeccionamientos recientes ideados por la "Union", los cuales ase-

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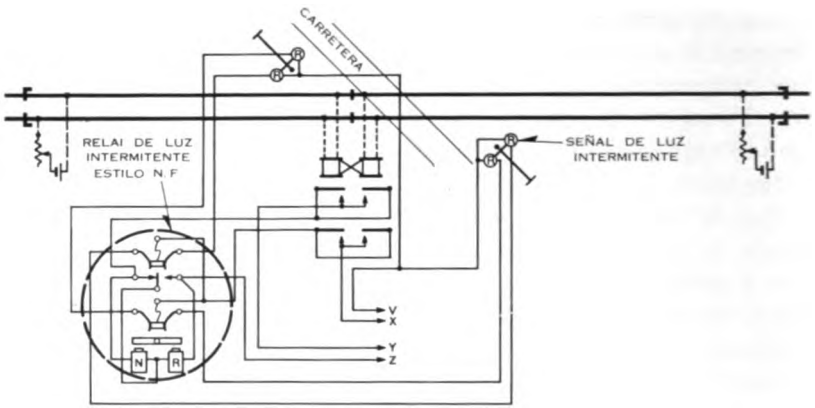

Fig. 3

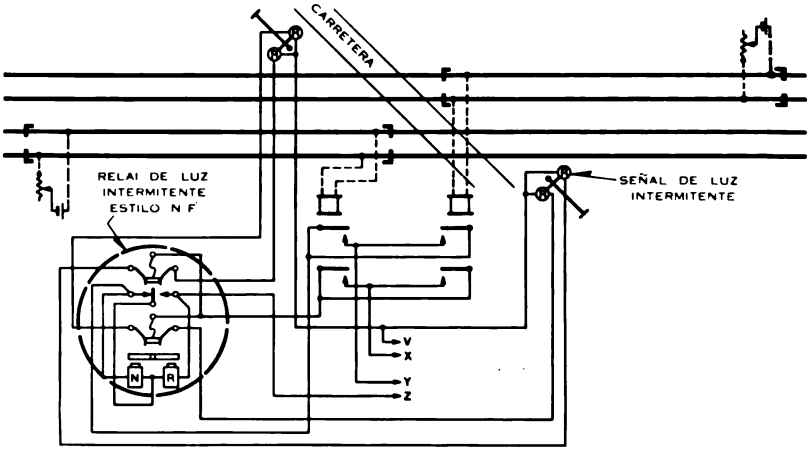

Fig. 4

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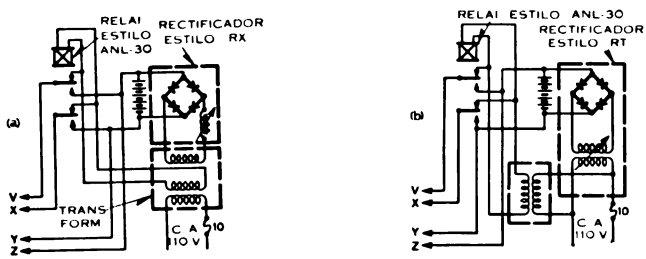
guran un suministro de energía económico e infalible para las instalaciones de señales de protección en los pasos a nivel. Los dos sistemas de batería representados por los esquemas (a) y (b) pueden ser adaptados a los esquemas de las Figs. 3 y 4. La elección de uno u otro depende generalmente del sistema adoptado por la empresa ferroviaria o del material se halle ya en servicio en el punto en que ha de hacerse la instalación. El esquema (a) utiliza el relai de transferencia de corriente ANL-30, un rectificador tipo RX y un transformador con arrollamiento secundario separado. Cuando falla la corriente alterna, el relai ANL-30 deja de ser electrizado y transfiere los circuitos de gobierno a la batería de reserva. En el esquema (b), se emplea un relai de transferencia de corriente ANL-30, un rectificador tipo RT y un transformador con un solo arrollamiento secundario. Los rectificadores de los estilos RT-10 y RX-10 tienen generalmente una capacidad ampliamente suficiente para cargar las baterías en los cruces sencillos de vía. Cuando se requiere mayor rendimiento, deben emplearse los rectificadores de los estilos RT-21 y RX-21.



Dos sistemas de batería aplicables a las Figs. 3 y 4

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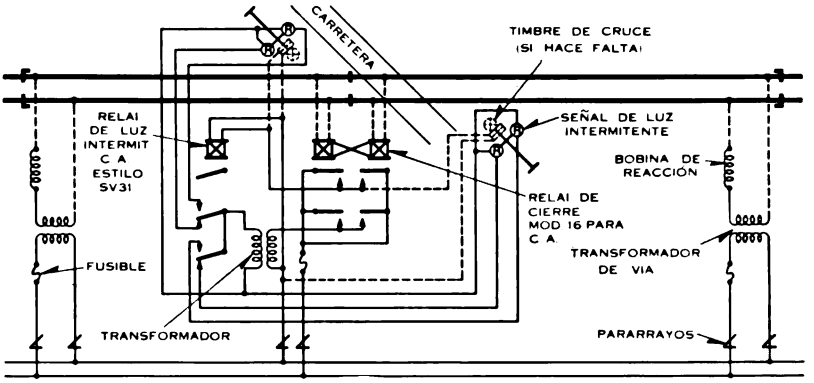

Fig. 5

Los esquemas Figs. 5 y 6 representan instalaciones automáticas y sencillas para la protección de los cruces en los ferrocarriles de vía sencilla o doble con circuitos de vía de corriente alterna.

Los esquemas Figs. 7 y 8 representan instalaciones automáticas y sencillas para la protección de los cruces en los ferrocarriles de vía sencilla o doble con propulsión eléctrica. En estos casos,

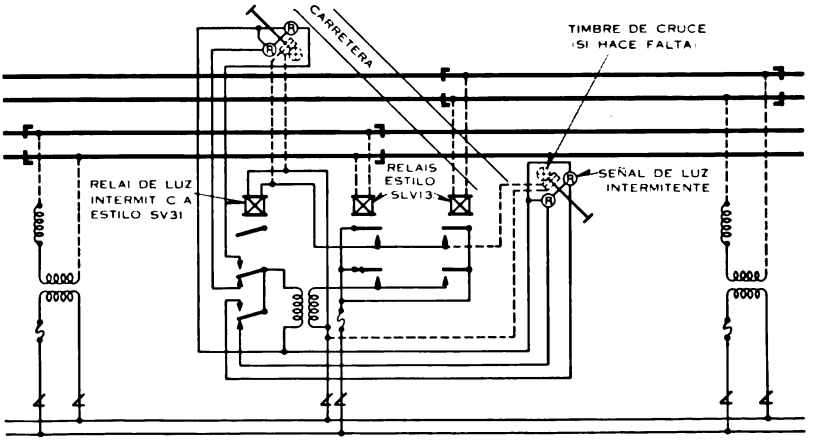

Fig. 6

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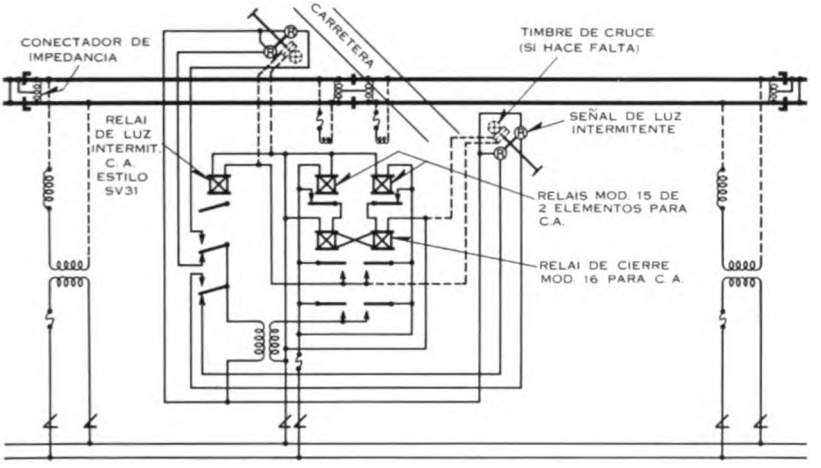
CONECTADOR DE IMPEDANCIA
CARRETERA
TIMBRE DE CRUCE (SI HACE FALTA)
RELAI DE LUZ INTERMIT. C.A. ESTILO SV31
SEÑAL DE LUZ INTERMITENTE
RELAIS MOD. 15 DE 2 ELEMENTOS PARA C.A.
RELAI DE CIERRE MOD. 16 PARA C.A.

Fig. 7

se emplean uniones de impedancia (véase la Sección F del catálogo) para que la corriente de propulsión pueda circular en ambos carriles, en torno de las uniones aisladas, y evitar al mismo

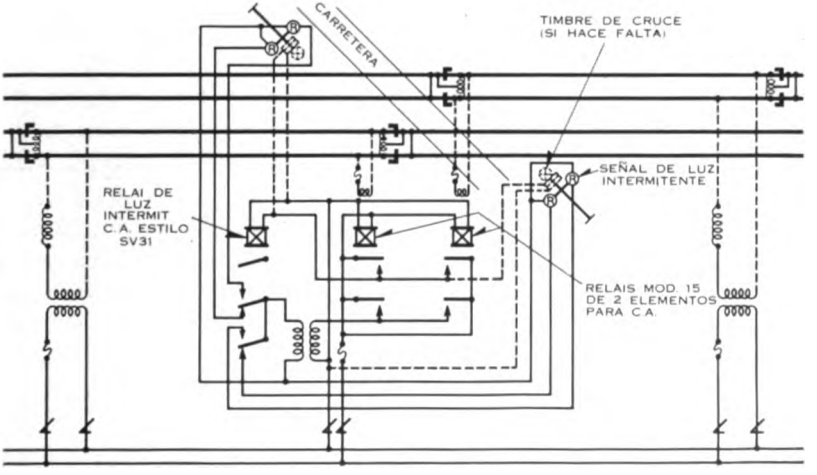
CARRETERA
TIMBRE DE CRUCE (SI HACE FALTA)
RELAI DE LUZ INTERMIT C.A. ESTILO SV31
SEÑAL DE LUZ INTERMITENTE
RELAIS MOD. 15 DE 2 ELEMENTOS PARA C.A.

Fig. 8

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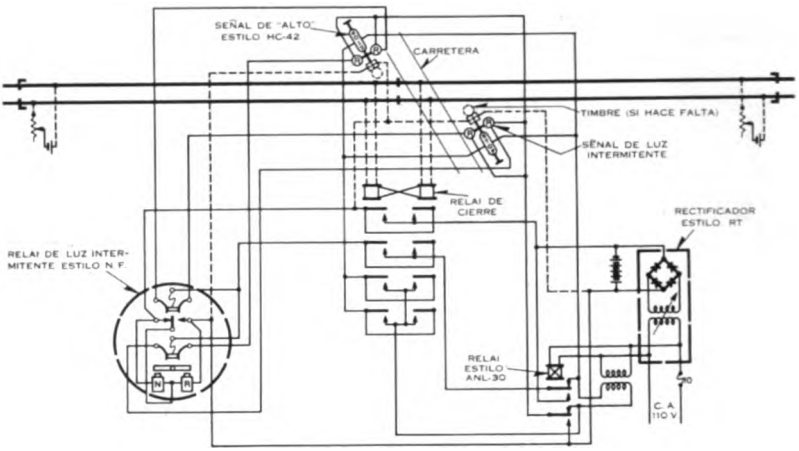

Fig. 9

tiempo que la corriente alterna pase de un circuito de vía al circuito contiguo. Debido a la impedancia de la unión, se mantiene la diferencia de potencial necesaria entre los carriles para el funcionamiento de los relais de vía.

El esquema Fig. 9 representa una instalación automática y sencilla para la protección de los cruces en los ferrocarriles de una sola vía, como se describe en las Figs. 1 y 2, y muestra además la aplicación del letrero de "ALTO" Union Estilo HC-42 que figura en la página 15. Este circuito puede fácilmente modificarse para obtener una señal de luz intermitente de "ALTO" en lugar de la señal fija de "ALTO".

El esquema Fig. 10 representa una instalación automática para la protección de los cruces en los ferrocarriles de una sola vía

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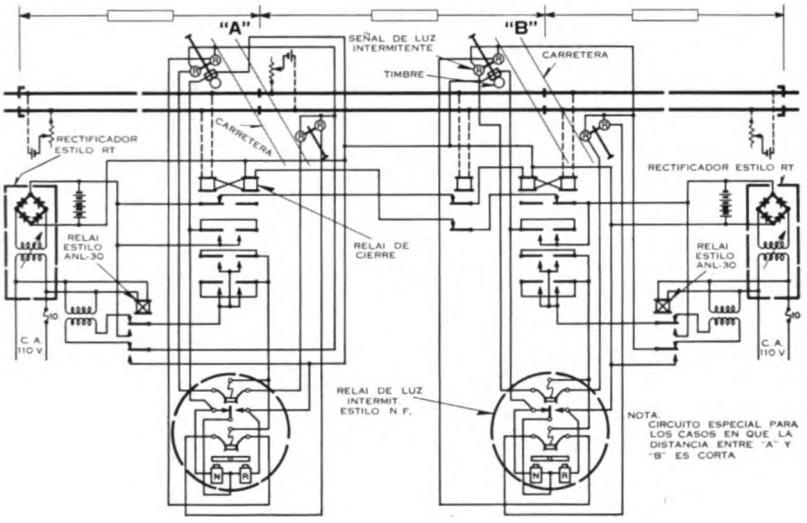

Fig. 10

con circuitos de corriente continua y dos pasos a nivel situados a una distancia aproximada de una cuadra de uno a otro. Los elementos constitutivos de esta instalación no difieren de los anteriores sino en unos pocos detalles.

Con este arreglo, las señales "A" y "B" empiezan a encenderse simultáneamente cuando se acerca un tren en una u otra dirección, mas dejan de funcionar una después de la otra a medida que el extremo posterior del tren pasa los cruces respectivos. Los circuitos y sus elementos pueden variar de acuerdo con la distancia entre los cruces, la cual, en este caso, puede calcularse entre 200 y 400 pies (60 a 120 metros). El período de acceso, basado en la velocidad máxima permisible del tren, determina en gran parte la clase de aparatos que se necesita y la disposición de esos aparatos (véase el gráfico, página 37).

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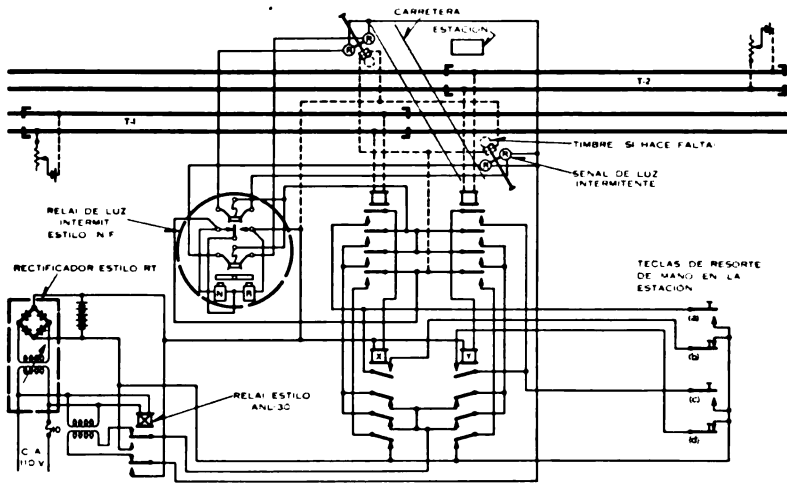

Fig. 11

El esquema Fig. 11 representa una instalación para la protección de los cruces en un ferrocarril de doble vía con circuitos de corriente continua, regida semiautomáticamente desde una estación o una torre. Este arreglo resulta conveniente cuando los trenes pueden quedar detenidos por largo tiempo en las estaciones. Pueden hacérsele las modificaciones necesarias para adaptarla a las condiciones que rijan en los diversos lugares.

Cuando un tren está parado en el circuito de vía T-1, el encargado en la estación, para hacer cesar la señal de aviso, cierra momentáneamente la tecla (a) para accionar el relai de línea X, el cual permanece entonces electrificado por un circuito "de paro" normalmente cerrado por la tecla (b). Por otra parte, cuando se oprime momentáneamente la tecla (b), el circuito de

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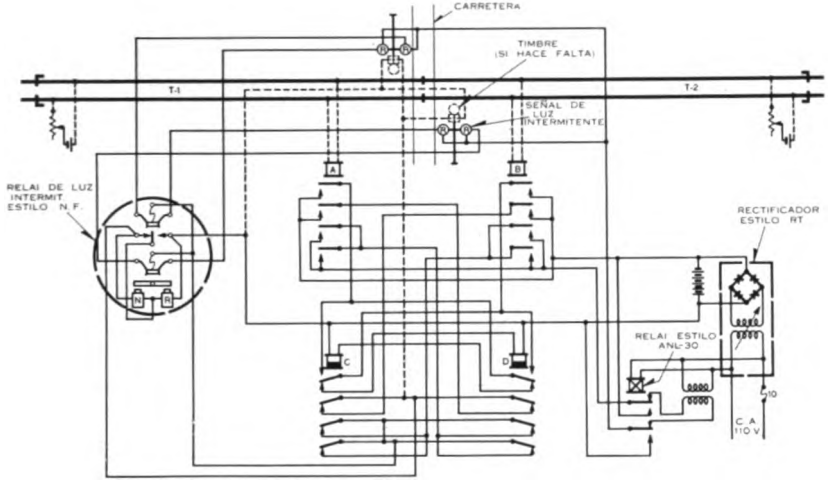

Fig. 12

"paro" se abre y la señal de aviso vuelve a funcionar. Asimismo, el relai Y y los conmutadores de tecla (c) y (d) sirven para interrumpir y reestablecer el funcionamiento cuando un tren se halla en el circuito de vía T-2.

En algunos ferrocarriles, se emplean relais de paro en unión de los relais de vía para obtener los mismos resultados que con los relais de cierre. El circuito representado por el esquema Fig. 12 constituye un ejemplo típico de lo que ciertas empresas emplean para los cruces sencillos.

El esquema Fig. 13 representa la aplicación del Guardavía Automático "Union" Estilo DW (descrito en la página 16) a un cruce o paso a nivel en un ferrocarril de una sola vía. El relai de cierre tiene "contactos de guardavía" (descritos en la

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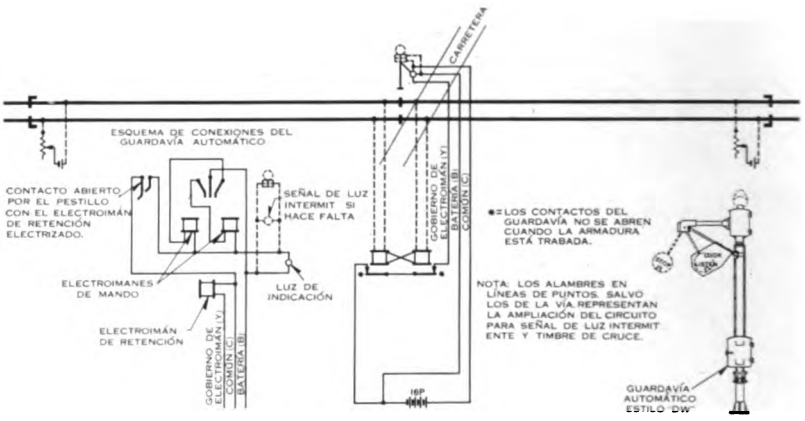
CARRETERA
ESQUEMA DE CONEXIONES DEL GUARDAVÍA AUTOMÁTICO
CONTACTO ABIERTO POR EL PESTILLO CON EL ELECTROIMÁN DE RETENCIÓN ELECTRIZADO.
SEÑAL DE LUZ INTERMIT SI HACE FALTA
ELECTROIMANES DE MANDO
LUZ DE INDICACIÓN
ELECTROIMÁN DE RETENCIÓN
GOBIERNO DE ELECTROIMÁN (Y)
COMÚN (C)
BATERÍA (B)
GOBIERNO DE ELECTROIMÁN (Y)
BATERÍA (B)
COMÚN (C)
*=LOS CONTACTOS DEL GUARDAVÍA NO SE ABREN CUANDO LA ARMADURA ESTÁ TRABADA.
NOTA: LOS ALAMBRES EN LÍNEAS DE PUNTOS, SALVO LOS DE LA VÍA, REPRESENTAN LA AMPLIACIÓN DEL CIRCUITO PARA SEÑAL DE LUZ INTERMITENTE Y TIMBRE DE CRUCE.
GUARDAVÍA AUTOMÁTICO ESTILO "DW"

Fig. 13

página 39) que cierran el circuito del electroimán tan pronto como la zaga del tren ha pasado el cruce, de modo que la señal cesa de funcionar. Pueden emplearse sistemas de alimentación iguales a los que se indican en los demás esquemas de circuitos, obteniéndose fácilmente una protección adecuada en los cruces de dos o más vías mediante el empleo de uno o dos guardavías automáticos.

La longitud de los circuitos de acceso y la velocidad máxima permisible de los trenes determinan el tiempo o período de aviso, es decir, el momento en que la señal ha de empezar a funcionar antes de que el frente del tren comience a cruzar la carretera. Según las recomendaciones de la American Railway Association, basta generalmente un período de 20 a 30 segundos. Suponiendo

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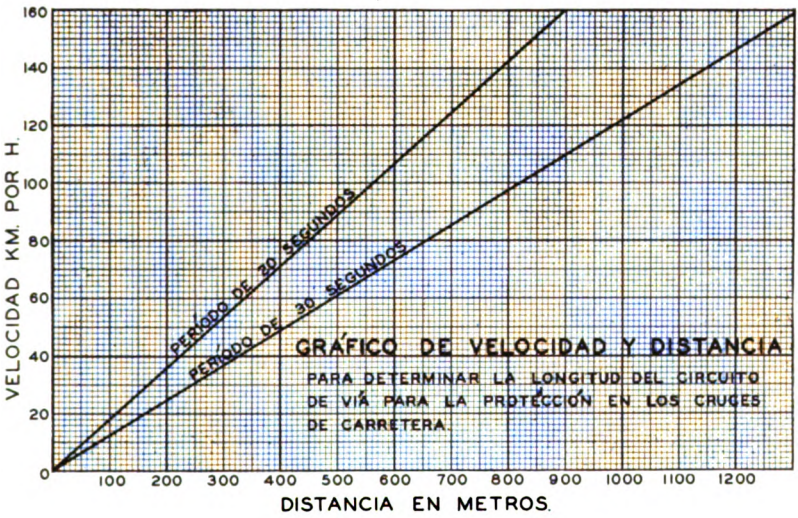

Fig. 14

Longitud del circuito de vía determinado por la velocidad máxima y el período de acceso

que se adopte un período de 30 segundos y que la velocidad máxima permitida sea de 100 Km. por hora, se hallará la longitud del circuito de vía (820 metros) en la línea horizontal (Fig. 14) inmediatamente por debajo de la intersección de la curva 30 segundos con la línea correspondiente a 100 Km. por hora.

Las dos secciones de vía de acceso a un cruce de carretera pueden variar en cuanto a longitud, de acuerdo con las condiciones de tráfico que rigen el movimiento de los trenes al acercarse al cruce por uno u otro lado.

El funcionamiento del relai de cierre "Union" queda explicado por los cinco esquemas que figuran en sequida, en los cuales se ve un tren pasando por los circuitos de vía. Al soltarse D Fig. 15 (b), el brazo H empuja el pestillo de cierre F hacia el

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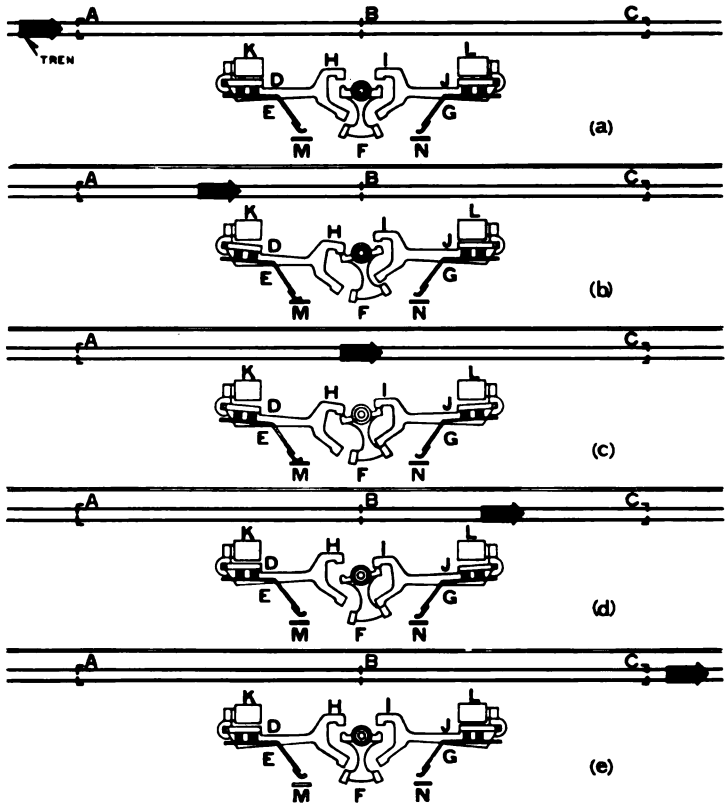

Fig. 15
Funcionamiento del relai de cierre común

brazo I. Cuando L queda deselectrizado, el brazo I se suelta y se traba con el pestillo F como se ve en la Fig. 15 (c). El contacto NG no se cierra, de manera que la señal de cruce cesa de funcionar cuando el último vagón del tren ha pasado el cruce. Gracias al arreglo simétrico del circuito y al dispositivo de cierre, se obtiene el mismo funcionamiento cuando el tren avanza en sentido contrario.

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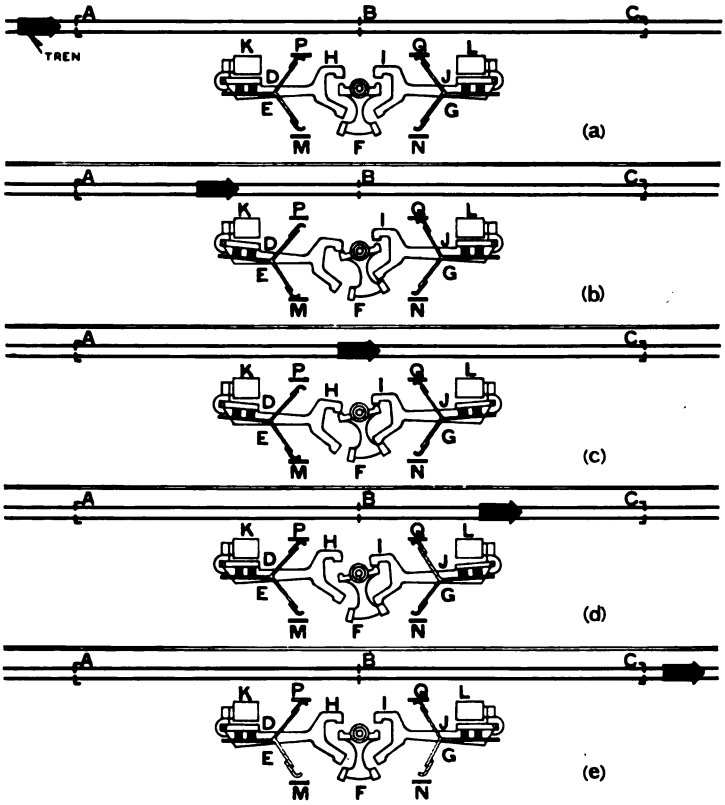

Fig. 16
Funcionamiento del relai de cierre con "contactos de guardavía"

En algunos de los esquemas de circuito, se observará la expresión "contacto de guardavía" entre las anotaciones explicativas. El contacto de guardavía es un contacto delantero tal como QJ Fig. 16 (c) que no interrumpe el circuito cuando su brazo de cierre I entra en contacto con el pestillo de cierre F después de haber sido empujado por el brazo H hacia I. El contacto de guardavía tal como PD Fig. 16 (b) se abre cuando su armadura es la primera de las dos que se suelta.

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Datos que deben acompañar toda solicitud de informes

Tendremos el mayor gusto en someter los datos técnicos y los precios del material para las instalaciones de protección en los pasos a nivel. Toda solicitud de informes debe venir acompañada de un plano a escala de la vía en que se vean la carretera y los cambiavías o los aparatos de señal que queden dentro de la sección de acceso, debiéndose dar los detalles siguientes:

Indíquese

1—Cuáles son las condiciones especiales del movimiento de trenes dentro de la región.

2—Si el ferrocarril es a vapor o eléctrico.

3—De qué clase de corriente se dispone para las señales.

4—Si la corriente es alterna, cuáles son el voltaje y la frecuencia, y si se necesita una fuente de corriente de reserva (¿Puede contarse con la regularidad del servicio de corriente?).

5—Tipo de señal de cruce:

(a) De luz intermitente, (b) Guardavía automático DW. Si se desea (a), dígase si se quiere con letrero de "ALTO" iluminado y luces laterales.

6—Longitud de la sección de acceso de cada lado del cruce. (Véase el gráfico de la página 37).

7—Si la línea es de dos vías, dígase si se desea protección en ambos sentidos de marcha de los trenes.

8—Peso y tipo de los carriles, y si las juntas aisladas de los carriles o rieles son de cuatro o de seis agujeros.

9—Dígase si el balasto es de piedra, de cascajo, de arena u otro material.

10—Si las señales han de quedar a un lado o en el centro de la calle o carretera. En este último caso, si se desean luces indicadoras.

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11—Si la carretera es del tipo pavimentado, de tablones o de tierra. Si es pavimentada, cuál es la clase de pavimento.

12—Si se desea la señal con letrero de cruce transversal. Si ha de llevar timbres y, en tal caso, si se desea uno o dos timbres.

Tratándose de un ferrocarril eléctrico

13—Indíquese el voltaje de la corriente y si ésta es continua o alterna. Si es alterna, indíquese la frecuencia.

14—Cuál es la corriente de retorno normal y máxima en los carriles.

Para obtener los datos completos acerca de los pedidos de las diversas combinaciones así como los detalles relativos a la Señal de Cruce Estilo HC-5 y la Señal de "Alto" Estilo HC-42, véase la Sección K del Cátalogo—Láminas K-120 a K-137.

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Union Switch & Signal Company

OFICINAS GENERALES Y TALLERES: SWISSVALE, PENNA., U. S. A.

Superficie total de pisos: Más de 93.000 metros cuadrados

Creadores, fabricantes e ingenieros constructores de señales y aparatos de enclavamiento electroneumáticos, eléctricos, electromecánicos y mecánicos, para ferrocarriles.

Señales de block automáticas, semiautomáticas y de mano.

Enclavamientos electroneumáticos, eléctricos, electromecánicos, mecánicos y automáticos.

Aparatos de gobierno automático de trenes, retardadores de carros, aparatos de protección para pasos a nivel y material de gobierno por despachador.

Piezas forjadas y fundidas para ferrocarriles, automóviles y usos generales.

Nuestras secciones comercial y de ingeniería están en situación de estudiar todos los problemas relacionados con la técnica de las señales. Se suministran planos y presupuestos.

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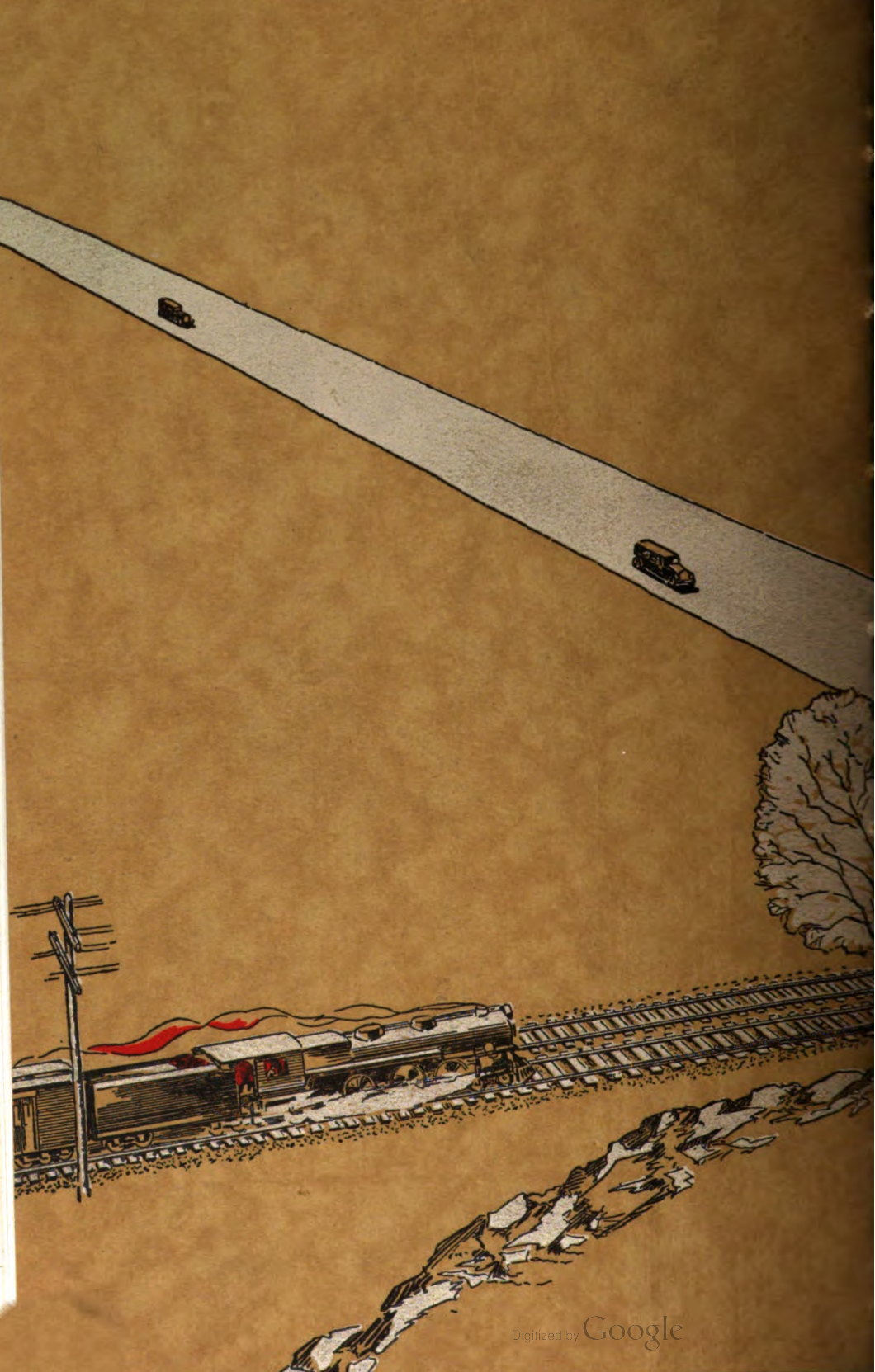
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